THE IRON TRADE REVIEW

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THE IRON TRADE REVIEW.

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CLEVELAND, O., NOVEMBER 6, 1890.

THE WEEK IN IRON CIRCLES.

General Features.

The Central Western States have just gone through an exciting political campaign which, if not as significant in results as a national contest, still possessed many features of more than mere local interest, since in this section was fought the great battle of supremacy in the next House of Representatives. It is yet to early to accurately measure results, but certain it is that the friends of our present National Protection Policy have much reason to be disheartened with the outlook. Naturally, the iron market has been somewhat neglected for the more exciting events of the hustings, and, as usual, compensation is found in the study of the situation abroad. By a singular coincidence, the pig iron market of Great Britain presents features of striking similarity to those which have been noted in these columns as prevailing in our American markets for the past few weeks. From the report of our Manchester correspondents we learn that there has been a steady decline in values since the first of October—a condition of things painfully similar to our own. Coupled with this is noted an extreme stringency in the money market, a state of affairs that American iron manufacturers will understand and appreciate. Regarding our home markets, it is to be noted that the past week has only contributed to further complicate the situation as to pig iron, rather than to disentangle it. At Detroit, for instance, the condition of affairs as to pig iron is decidedly mixed. There can be no doubt but that certain grades of metal are as weak as the greatest pessimist could desire. To offset this to a certain extent, a very refreshing strength is seen where the demand is confined to Lake Superior charcoal and Northern silvery irons, which have been quite eagerly sought for. Statisticians are puzzled to know why lower figures should exist with stocks in makers' hands growing smaller continually. The turn for better figures cannot now be long postponed with the present immense consumption and active buying continuing. There were several transactions in Southern foundry and forge iron at very low figures, and a number of deals for Lake Superior and silvery iron closed, though smaller in tonnage than the Southern iron, at full figures. The market in Louisville and immediate vicinity has been very quiet during the past week. What few sales have been made were at a distance and for delivery during the first six months of next year. There has been no change in price, which remains at $10.50 for grey forge at Birmingham. There are parties in the market for a large amount of iron, but they desire delivery during all of next year. Some buyers profess fear that the reported weakness of steel and muck bar indicate that before long production will exceed consumption ; which they believe by the first of next year will fall off. This, however, does not prevent them from buying for legitimate needs on account of the low price of iron, but curtails purchasing in excess of ordinary requirements. Prices at Buffalo still remain low with very little business to report. While the same difficulty exists in getting shipments forward on old orders, actual buying is so very light as to suggest a reaction in the not distant future. The past week at Chicago has shown no decided tendency either up or down, and while there are those who predict a lower range of prices shortly, there seems to be nothing definite to warrant such a change. Consumption continues heavy, and while no very large business is going, there is a steady flow of moderate sized orders. Southern iron is in good demand, especially soft and silvery grades. Lake Superior charcoal continues quiet, but indications point to heavy buying in the near future. At Cincinnati it is noted that the statistical position of the market for pig iron has remained strong. No diminution of consumption has taken place and no accumulation of iron at furnace yards. On the contrary the capacity of the largest Southern furnaces for the remainder of the year, has been and still remains heavily oversold. The outlook for a large volume of business in all commercial lines during the Winter and early Spring, is regarded by those best able to judge, fortified by experience, as secured. With continued activity in industrial lines, the demand for pig iron and steel is likely to be increased, and the present low prices reported as being made, will rebound as a natural sequence. For the time being, however, the market is still disturbed by reports and rumors of numerous sales of moment, at very low prices, indicating financial needs of some producers. The sales made have been largely of mill grades, but there have also been some liberal transactions of both No. 3 and No. 2 foundry. There has been but a moderate movement in Ohio softeners, and only a few important sales of charcoal iron. At St. Louis considerable business is being done and consumption continues large. Our report from Pittsburgh is to the effect that pig iron for foundry and mill purposes has been in reasonably good demand during the past week at unchanged prices.

Iron Ore.

There is so very little going on in the iron ore market that only those directly interested are at all aware of its existence. The shipments are steadily going forward, at a greatly reduced rate, however, owing in part to the scarcity of vessels, and, in part, to the lack of ore in some of the shipping ports. The recent sharp advance in coal freights has diverted a number of vessels from the ore trade into the coal trade, and as the last selling prices of ore will hardly permit any exorbitant carriage, the chances are that no further change will occur in the conditions governing the vessel market. The rough weather of the week has done much toward the laying off of several vessels, and more will undoubtedly follow during the next few days, unless the inducements offered by coal shippers should be such as to overbalance the insurance draw-back and the increased vessel charges. It may not be impossible that with adequate railway facilities, and moderate charges, this Winter will see all-rail shipments of ore. The demand from Eastern furnaces for a high grade of Bessemer ore is very urgent, and in some instances local furnacemen, unable to make pig iron at a profit, have resold their ore to these firms at no inconsiderable advance. It is thought that the East can consume between this and the opening of navigation, next Spring, fully half a million tons of ore, and it is not at all unlikely that a way may be found to forward it at a moderate cost.

Pig Iron.

No change for the better can be reported, and that no change for the worse has taken place is due to the sole fact that the worst has long been reached, and the furnace interests defy any further depression either of the price or in the volume of business. The general opinion of the trade seems to be that the business is dead, and that statement seems to be pretty generally accepted and recognized as a fact too plain to bear even discussion. Sales continue to be made as before, in beggarly quantities, and for hand-to-mouth consumption, at the same old starvation prices. Even the largest buyers in other days seem afraid, for some mysterious reason, to touch pig iron, when common sense must make it apparent to everybody in the business that pig metal has for some time been selling below actual cost, and that, this slump once over, it will be a long time before the furnacemen will again be caught in their present predicament. The general elections of the week have added their share in adding a quietus to an already quiet market, and trade is so dull that the bulk of the iron men in this line could safely take a vacation until after the holidays.

OUR STEEL SUPREMACY.

Although the public has been kept well informed through the admirable reports of Mr. James M. Swank, General Manager of the American Iron and Steel Association, as to the annual progress of the United States in the production of steel, the census returns for the year ended June 30, 1890, as collected by Dr. William M. Sweet, of Philadelphia, special agent, possess peculiar interest as showing the advancement made during the past decade. The preliminary report of Dr. Sweet has just been sent out in the form of a census bulletin, and is now before us. From it we learn that the total production of steel in the form of ingots and direct castings aggregates 4,466,926 tons of 2,000 pounds, an increase of 290 per cent. over the production of the census year 1880, at which time steel was made in fourteen States in the Union, as against nineteen States engaged in that industry at the present time. The production of Bessemer steel rails has shown a remarkable growth, increasing from 741,475 tons in 1880 to 2,036,654 tons in 1890. The following table gives the comparison in detail:

Kinds of Steel. (Ingots or direct castings.)	Tons of 2,000 pounds. Year ended May 31, 1880.	Year ended June 30, 1890.
Bessemer steel	985,208	3,788,572
Open-hearth steel	84,302	604,351
Crucible steel	76,201	85,536
Clapp-Griffiths steel	.....	83,963
Robert Bessemer steel	.....	4,504
Total	1,145,711	4,466,826

Pennsylvania continues to occupy the position of the leading producer of steel in the United States, producing 57 per cent. of the total production in 1880 and 62 per cent. in 1890. Illinois was second in rank in both years, and Ohio was third. From 1880 to 1890 the increase in production in Pennsylvania was 324 per cent., in Illinois 241 per cent., and in Ohio 314 per cent. Since 1880 the manufacture of steel has been abandoned in two States, viz., Rhode Island and Vermont, and seven States have engaged in its production, viz., Alabama, California, Colorado, Indiana, Michigan, Virginia and West Virginia.

The relative position of the different States, as steel producers in the order of their present rank, is shown by the following table (tons of 2,000 pounds):

State.	Production of Steel of all Kinds. 1880.	1890.	Percentage of Total Production. 1880.	1890.
Pennsylvania	653,561	2,768,253	57.04	61.97
Illinois	254,569	868,250	22.22	19.44
Ohio	107,883	446,808	9.42	10.00
West Virginia	.....	183,225	.....	4.10
New York	86,745	113,499	7.57	2.54
Massachusetts	9,615	30,252	3.75	1.95
New Jersey	10,942	17,999	3.75	1.95
Colorado	.....	17,952	.....	1.95
California	.....	6,904	.....	1.95
Michigan	.....	5,604	.....	1.95
New Hampshire	4,521	3,700	3.75	1.95
Connecticut	2,116	1,734	3.75	1.95
Indiana	.....	1,350	.....	1.95
Maryland	.....	1,400	.....	1.95
Alabama	.....	300	.....	1.95
Tennessee	.....	100	.....	1.95
Total	1,145,711	4,466,926	100.00	100.00

Besides the above, Virginia, Kentucky and Maryland report steel works, but no product. Rhode Island reported steel works, but no product in 1880, and disappears from the column in 1890.

The six States bordering on the Great Chain of Lakes, viz., New York, Pennsylvania, Ohio, Illinois, Indiana, and Michigan—produced in the census year of 1890, 4,203,760 *tons of steel, or* 96.3 *per cent. of the total steel production of the country. This aggregate is nearly* 100,000 *tons greater than the total steel production of Great Britain in* 1889.

THE PASSING OF SCOTCH PIG.

That Scotch pig iron has for some time been losing its foot-hold in the United States has been too well known to require statement. It has remained, however, for a candid and intelligent London contemporary, the *Coal and Iron Trades Review*, to gracefully acknowledge not only this fact but the equally significant fact that, in Canada, Scotch pig iron is giving place to the American article. "The low-priced pigs," it says, "now produced in certain parts of the United States have gradually squeezed out the Scotch product, which is now very rarely mentioned in the market reports." Indeed, it adds, "if it were not that Scotch pig is so useful for freightage purposes, it is doubtful whether the quantities sent to the United States would not dwindle to zero to-morrow so far as legitimate demand is concerned." As to Canada, a communication was recently received from Toronto by a firm of Glasgow merchants, in which the writer, referring to this important matter, observes: "The American prices of low grade iron have, relatively to Scotch, been so low that we have gradually substituted them, and to-day (October 6th) we have about decided to drop the Scotch altogether, and substitute American, the difference in price at the present advance being so marked." "It is evident," remarks our London contemporary, "that the main question in the latter case is that of price, and if the Scotch makers are unable to put their iron in the Canadian market at as low a figure as the Americans, they will be driven from that market, too, just as they have been from the United States." "This is all the more to be regretted," it adds, "as, during the past few years, our exports of crude iron to Canada have shown an increase."

Inasmuch as the imports of Scotch pig into the United States now average only about 2,000 tons a week and the Scotch article is seldom quoted, the above candid admission would seem to be well grounded.

PROSPEROUS TIMES AMONG BIG STEEL WORKS.

Whether the information of the Philadelphia *Times* is authentic or not, it is "mighty interestin' readin'," concerning the present prosperous condition of the large iron and steel concerns of Pennsylvania. According to this authority, the four following concerns have lately increased, or are about to increase, their capital stock to the amount stated, and have paid dividends, as asserted, during the past fiscal year:

Name of Company.	Annual Dividend.	Increase in Capital.	Total Capital.
Pennsylvania Steel Co.	30 per cent.	$2,000,000	$5,000,000
Bethlehem Iron Co.	25 " "	2,000,000	5,000,000
Cambria Iron Co.	10 " "	1,000,000	5,000,000
Thomas Iron Co.	25 " "	500,000	2,500,000

We give the above figures without vouching for their correctness. In regard to the Cambria Iron Company it is stated that it has a surplus of $4,000,000. After making good the flood damage, $1,000,000, it is expected to pay 30 per cent. this year. It is also reported that the Phœnix Iron Company has created a mortgage for $1,000,000, with the proceeds of which it will enlarge the plant. The dividend of the Thomas Iron Company, it is said, represents earnings withheld from the stockholders and invested in the property. The company earned $483,000 in the year ending June 30, but only distributed 10 per cent. in dividends. An English syndicate bid $4,500,000 for the works, but the offer was refused.

Southern men, viewing these figures, are inclined to predict a great future for the Southern steel trade, when once developed, claiming that if the steel makers of Eastern Pennsylvania can make 30 to 50 per cent. on product wrought from imported and Michigan ores, costing from $6 to $8.50 a ton, the South can do fairly well at making steel from ores that cost from 75 cents to $1.25 a ton in the stockhouse. If (they go on to say) Pennsylvanians can thus prosper making steel from iron, the first cost of which is never less than $16 a ton, and will average near, if not quite, $20 a ton, certainly the South should get on with iron that can be smelted at a profit, and sold for $10 a ton.

The next two or three years will probably demonstrate what the South can do in the way of steel making.

GROWTH OF THE BESSEMER STEEL INDUSTRY.

The census returns of the production of Bessemer steel ingots and castings and Bessemer steel rails, during the year ended June 30, 1890, as compared with ten years ago, show a most remarkable growth. We group these figures as follows, net tons of 2,000 pounds being used:

States.	Bessemer Steel Ingots or Castings. 1880.	1890.	Bessemer Steel Rails. 1880.	1890.
Pennsylvania	556,314	2,297,726	409,339	1,377,119
Illinois	253,514	867,805	201,186	622,260
Ohio	82,811	385,576	66,480	17,335
New York	84,160	105,402	57,870	.....
Other States	8,409	220,530	6,600	19,940
Total	985,708	3,877,039	741,475	2,036,654

As will be seen, the steel rail industry has been concentrated within the two States of Pennsylvania and Illinois, Ohio standing third, but a long distance behind. In the production of steel, however, Ohio shows a decided advance over 1880.

The production of crucible steel has shown little progress during the decade, but open-hearth steel has sprung from 84,302 tons in 1880 to 504,351 tons in 1890, of which Ohio made 61,232 tons.

The total production of basic steel in the United States in 1890 was 62,173 net tons, and the prediction is made that it will soon become a large industry.

CONCERNING the foolish talk, that the legality of the new tariff law will be contested on the ground that there was a technical error in engrossing it, the *Tradesman*, of Chattanooga, Tenn., sensibly remarks: "The courts would hardly take the responsibility of throw-

ing the whole fiscal machinery of the country into confusion by abrogating so far reaching a law as the tariff, on a purely technical point. This is the more remote, because Congress can cure the defect before the question raised can possibly reach the Supreme court."

THERE has been a steady and unprecedented depletion of pig iron stocks in Scotland since the first of the year. Recent figures are as follows:

Stock at 31st December, 1889		937,056
	Withdrawals. Tons.	
January	30,601	
February	35,200	
March	44,834	
April	41,049	
May	41,743	
June	29,277	
July	25 892	
August	19,534	
September	19,524	
October (till 18th inst)	13,760	302,314
		634,752

These figures are significant, and we would suggest to English iron makers that they look out for breakers about the first of the year.

THERE appears to be an increasing disposition among Mahoning Valley iron manufacturers to use Southern pig iron mixture with red short Superior. One concern recently used 1,000 tons of the Southern article in this way and reports quite satisfactory results.

THE Youngstown (O.) *Telegram* is authority for the statement that the greater portion of the iron industries of the Mahoning Valley have been sold to an English syndicate. This is certainly important, if authentic.

IT may please the *Un-American Artisan* to learn that its adverse comments on the McKinley bill are copied in high glee by one of our English exchanges.

THE SCARECROW OF HIGHER PRICES.

The promptness with which journals in the conspiracy to depopularize the new tariff law have acted upon the order from headquarters to insist that a general advance in prices of manufactured articles will result from its enforcement has raised a conflict of veracity between publishers and their advertising patrons. While editorials are insisting that prices of all kinds of goods have advanced, merchants are paying for the use of the adjoining columns in which to set forth the fact of their willingness to supply customers at prices quite as low as have ever ruled for similar articles.

More than average temerity must exist on the part of writers or less than average intelligence be credited to readers in expecting men to disregard facts so readily within reach of every one who cares to look for them. Side by side with assurances from merchants of recognized responsibility that goods can now be bought of them at prices lower than ever before, free trade agents are repeating the stale maxim that any tariff on foreign products "raises the price to consumers of all articles imported and subject to duty by precisely the sum paid for such duties," and are insisting that "nearly or quite the same enhanced price" has been added to all protected articles of domestic manufacture.

Not only does the free traders' contention that tariff is added to prices find refutation in the advertising columns of most journals repeating that absurdity—it finds contradiction in the actions of the principal conspirators themselves. If true that foreigners have only to add the tariff to the selling prices of their products and our people will pay the difference, why such intense interest on the part of free trade attorneys—why such enormous expenditures of effort and money to break down protective barriers? Evidently they are wanting in candor as well as consistency.

It is the wholesome fear of losing American customers by having the wants of our people supplied from domestic manufactures—and not the fear of higher prices—that occasions European solicitude and inspires the activity of importers and other free trade agents this side the Atlantic. Voters who cannot see this despite the glamor of sophistry and clouds of misrepresentation by which it is sought to have the real facts concealed, have yet a lesson to learn, to which they can none too soon apply themselves.—[Illinois Branch American Protective Tariff League.

WITH a recent issue of *The Iron Trade Review*, of Cleveland, was published an excellent engraved portrait of Mr. Samuel T. Wellman, a prominent citizen of that place who has been connected with several of the leading iron and steel manufacturing concerns in the country, and whose engineering and inventive talents have given him a foremost place in the ranks of industrial chieftains. Among other important offices held by Mr. Wellman is that of President of the Gobeille Pattern Co., of Cleveland. He is also officially connected with the American Wire Co., of Cleveland, the Solid Steel Co., of Alliance, O., and the Spiral Well Tube Co., of New York. Mr. Wellman is about to leave Cleveland to fill the position of President of the re-organized Chester Rolling Mill Co., Thurlow, Pa., which will be known as the Wellman Iron & Steel Co.—[American Artisan, Chicago.

THE English engineering trades are brisk, and most of the steam engine makers continue full of work.

ELECTRIC WELDING APPLIED TO THE MANUFACTURE OF PROJECTILES.

BY LIEUT. W. M. WOOD, U. S. N.*

I am asked to-night to tell you something of a new process which has been originated and developed within the past year; a new and important application of an art in itself new, electric welding.

At this moment when there is so general an interest manifested throughout the country in the question of the nation's arms and defences, this new invention, which bids fair to supercede and immensely cheapen existing methods, is sure to claim its share of attention, both from experts in ordnance and the general public. * * *

For use against these various defences and where there are no defences except distance and advantage of position, there are in use three general classes of projectiles (not considering the more or less experimental dynamite and other high explosive shells). They are, 1st, the armor piercing shell, used solely, as its name indicates, against heavy armor; 2nd, common shell, used against unprotected vessels and troops, for bombarding cities and earthworks, for target practice, etc.; 3rd, Shrapnel, so named from its inventor, extensively used in field operations on shore against bodies of troops, and at sea against open boats, torpedo boats or any unprotected body of men.

Leaving the ordinary bullet of the shoulder rifle out of the question, these projectiles range in weight from those of a single pound to the gigantic missiles of the 110-ton gun which weigh about one ton and are driven by almost a half a ton of powder.

Now in order to show how much is gained in the construction of projectiles by the Thomson Electric Welding Process, I will briefly describe the present methods of manufacture.

1st. The Armor-Piercing Shell. To fulfil the Government requirements these must be made of a fine quality of steel, capable of being made very hard and still be tough. In the first operation, it is forged or rolled into a rough solid blank. After this it is placed in a lathe and turned off accurately on the outside and the powder chamber bored in the axis of the shell from the base, as in this specimen. This opening is then closed by a carefully fitted screw plug, in the centre of which is a smaller threaded hole into which fits the percussion fuse which explodes the shell on impact. A groove is now turned in the outside near the base and knurled or roughened. This is for the copper rotating band, and the roughening is to prevent its slipping when the copper enters the rifling of the gun. Next the shell is hardened by one of the various processes which are more or less satisfactory, and finally the copper band is forced into place by hammering or hydraulic pressure and turned off true to guage. This completes the projectile and you will readily understand that all of this work is slow, tedious and expensive. Anyone who is familiar with the operation of machining high carbon or tool steel, will appreciate this. As a matter of fact, a 6in. armor-piercing shell which only weighs 94 lb. costs in the neighborhood of $65 or $70.

Next come common shell. These at present are cast either of steel or iron, but even in this cheap form of production many difficulties are met with. In the first place, the shell usually has but one small opening to the inside powder chamber and this only allows the use of a single "print" to hold up the core which forms the interior cavity, consequently, when the molten metal flows in, it pushes this core out of place, and the resultant casting is eccentric—thin on one side, thick on the other—frequently so much so as to cause it to be discarded entirely. When the castings are received from the foundry they are first carefully calipered on the inside by a skilled operator, who uses a delicate instrument called a "star gauge," which expands within and enables him to determine the amount the casting is out of true, which he marks on the shell. It is then passed to the hands of the machinist. He is obliged to place it in his lathe eccentrically, so that the outside will be turned true with the inside; and you can imagine that even after all this care they are never perfectly concentric. Another serious difficulty met with in the cast projectiles is the liability to small blow holes or porosity, which, though they sometimes escape detection, always cause the rejection of the projectile when discovered. Through these holes the gases of the charge might be driven and thus cause a premature explosion of the shell in the gun. Steel shell of this description, of 6 in. calibre, cost about $30 each. Like the armor-piercing shell, they are fitted with rotating bands and fuses, but are not hardened.

We now come to the Shrapnel. It was originally invented for use in the smooth-bore guns of the past and was then a hollow sphere filled with small bullets, around which was poured melted sulphur as a matrix. A small powder chamber for a bursting charge was left in the middle. It was provided with a time fuse which could be set so that the shell would explode at the desired moment in its flight, scattering its contents and fragments in the face of the enemy. So far, there seems to have been no very satisfactory Shrapnel made for rifle guns. The difficulty is that the head or base has to be screwed on after the body of the shell has been filled with the bullets and matrix. This construction weakens the projectile very much at this point, and the head or base is apt to blow out without bursting the body of the shell or scattering the bullets, especially as the walls of the projectile have to be made thick enough to stand the threading.

Hoping I have now made clear the general state of the art, I will explain wherein the new process differs, and will endeavor to illustrate it by the specimens I have here.

First, instead of the solid, rough forged ingot, we have these three component parts, which when welded together will form a 6 lb. armor-piercing shell. Each piece is now finished to exact size, except that there is a little extra length to allow for the take-up in welding. The head and base pieces are forged in dies to shape; the central portion is simply a piece cut from a

*Paper read before the Society of Arts, Institute of Technology, Boston, October 23, 1890.

length of solid drawn steel piping. It has all the additional strength due to the fibrous skin inside and out caused by the drawing process. To join these three pieces, they are clamped into a form of electric welding machine designed for the purpose, and in less than a minute are joined together and made a homogeneous mass like this.

It now only remains to grind off the two burrs which you see in this specimen, and cut in the grove for the rotating band. The front one of these burrs may be used to form an enlargement used in many forms of projectiles, called technically, a "bourillet." It supports the front portion of the shell in the bore of the gun, the remainder not touching except at the rotating band. The other burr may be removed at the same time the rotating band groove is cut. The fuse hole has already been cut and threaded in the base piece. The shell is now ready for the hardening process. I wish call attention here to the fact that the burrs are allowed to remain on the inside and thus form the strengthening ribs, which help materially to support the shell against the great crushing strain it receives on impact. You will see that we have thus formed a stronger and better shell with minimum of labor on the individual parts and a few seconds' work to join them together.

In order to illustrate the wonderful strength that may be gained by this welding process, I have here a shell which was constructed exactly as I have shown. It was fired through a 3-in. plate at the Naval Proving grounds at Annapolis, recently. You will see that it has not changed its shape in the slightest degree, nor has it even lost the copper rotating band which was carried through the hole with it. Here is another which shows a still more remarkable result. This projectile was fired against heavy steel armor which has a resistance of about 75 per cent. more than iron, and which was heavier than a projectile of this size could be expected to perforate. It, however, penetrated five inches, and then owing to the elasticity of the oak backing, was thrown back about 80 feet as perfect in condition as when it was fired from the gun. The experience of the Welding Co. has been that the metal seems to be strengthened at the point of welding, and this certainly seems to justify the supposition.

After accomplishing results like this, you will see that the manufacture of the common shell becomes a very simple matter. By the welding process, it is feasible not only to join iron to high carbon steel, but to weld wrought iron or steel to steel castings or even to cast iron. Hence, in this case, it is only necessary to substitute common iron or low carbon steel tubing and stamped or cast heads and bases and perform the welding operation. The shell which is thus cheaply put together has all the advantages of wrought and none of the disadvantages of cast metal. If made of low steel, it may even be hardened to a certain extent and thus have more or less efficiency against thin armor.

In regard to the Shrapnel, a single look at this section will show the problem and how it has been met. This is from a design for the United States army 3.2 inch field piece. The head and base are steel castings, which have been heated and compressed to give them density. The body is drawn steel tubing one-fourth inch thick. The projectile was built as follows: First, the head was welded on to the body. Next the brass tube which carries the flame from the fuse to the powder chamber at the base was crimped in at the upper end. The half-formed projectile was then inverted and the bullets placed within and the matrix poured about them. Next, the diaphragm which forms the front end of the powder chamber was put into position and the other end of the tube crimped in. The shell is now ready for the final weld, and you will notice that the base piece is provided with a shoulder, which after the weld is made, will press closely upon the diaphragm and support it againgt the shock of the discharge. After the second weld is made, the Shrapnel has an unbroken surface enclosing its deadly bullets, and like the other shell is ready to be fitted with rotating band and fuse.

To summarize: these shell can be produced in the method I have described so that a wrought steel projectile can now be manufactured at less cost than a cast iron one, which except for target practice is almost worthless; and as for armor-piercing shell or even moulded steel shell, there can be no comparison as to cost of production. This same principle can also be applied to solving a still more difficult problem, and one which has hitherto baffled the skill of the inventor, viz, the welding the solid heads on to the large brass cartridge cases now used with the projectiles of rapid fire guns. A rapid fire gun is one having a non-recoil and a pivoted mount. It is aimed and fired from the shoulder like an old-fashioned swivel. They range in size up to as large as the 6-inch gun. The ammunition is fixed just the same as the bullet and cartridge of a shoulder rifle. At present these brass cases are constructed with great difficulty and at much expense from the solid ingot, and no one is prepared to make those of the large sizes in this country. By the Thompson process, which also welds brass and copper, this will be an easy matter and the cost should be less than one quarter that now paid by the Government for those they are obliged to import.

In conclusion, I will say that it is a well-known fact among ordance experts that the breach mechanism and the principle of construction of the present high powered guns are entirely due to American invention, which was, however, forced out of the country by lack of appreciation and was taken up and developed in Europe. I believe the day has come at last when our military inventors will not have to seek their encouragement entirely abroad and I think that in the very near future our government will be supplied entirely by cheap and effective projectiles of the kind I have shown you to-night.

SIR JAS. KITSON, President of the British Iron & Steel Institute, who recently made a tour through this country, says: "It is possible to make iron in the South as cheaply as in any part of the world." Percy Gilchrist, one of the founders of the basic steel process, says: "The ores are peculiarly adapted for making steel." Wm. White says: "Basic steel, made from Tennessee iron compares favorably with that made in England."

IRON MINING IN CANADA.

Already there seems to be considerable desire to promote the mining interest of our country. Meetings are being held, in fact small stock companies are forming, with the object in view of developing Canadian mining industries. Much has been said of establishing smelting works in Toronto, as this seems to be an advantageous point for such an undertaking. Mr. Arthur Harvey is one who takes a lively interest in these matters, and deserves a hearty support from all those who approve of bringing to light the great necessity of developing our vast mineral resources. At a meeting held in this city, it was proposed to start a joint stock company to develop our mining industries, but the amount proposed is too small to lay out for an undertaking of so vital importance as this one promises to be. We quote an abstract below of proposals which appear more commendable as regards this object:

1. That a vigorous attempt should be made to establish iron smelting works in Ontario, and that no point seems to offer better advantages than the city of Toronto or its immediate vicinity.

2. That a committee be formed to solicit stock for a joint stock company having this object in view.

3. That the minimum amount of stock to be taken before any operations are commenced should be $100,000; that 10 per cent. be paid in upon subscription, and that a further call of 10 per cent. be payable one month after the charter is obtained.

4. That all money paid in be refunded in full within four months, unless at least $100,000 be subscribed.

5. That as soon as the charter is obtained, a board of directors be appointed, and that the following be their duties:

(*a*) To secure a suitable site.

(*b*) To arrange for such exemptions from taxes, and such bonus encouragement as may seem fit to the municipal and other authorities.

(*c*) To build ore sheds, and buy a sufficient quantity of ores from Canadian mines; thus enabling owners of iron locations to find a market, and so helping in the opening up of iron beds.

(*d*) If practical demonstrations be thus received that ores of sufficient quantity and of satisfactory quality can be had (the sum spent in such purchases not to exceed $10,000), the board may proceed with the erection of furnaces, and the business of smelting iron and other metals as to them may seem most fit—calling up the remainder of the stock at the rate of 10 per cent. each month.

6. That the committee mentioned in section 2 consist of Messrs. ———, and that Mr. ——— be the honorary secretary and treasurer.

7. That the shares be placed at $100 each, as it is desirable to place the stock in as many hands as possible, so that the effect may be, so to speak, of a national character.

8. That the name of the company be "The Toronto Iron Smelting Co.," and the stock list hereto attached be offered for signatures under the above-mentioned conditions.—[Hardware, Toronto.

Hardening Cast Iron.

We are informed that the Abbott Machine Co., 47 and 49 South Canal street, Chicago, have lately been conducting some very satisfactory experiments in hardening cast iron by a new chemical process. Briefly described, the mode of procedure is as follows: The iron is put in a furnace and heated to the proper temperature, when the chemical is put on the upper side and goes right through it, so that when cool the under side is as hard as the upper side, and when broken the iron is as hard inside as outside. No trouble is experienced in going through six inches, and the chemical can probably go through any reasonable thickness. In Chicago it is being used for hardening brick dies made of cast iron, whereas heretofore brick dies were necessarily made of steel. This is a great saving both in material and work. Another use is for shoes on grips of cable cars, the iron shoes formerly used sometimes not lasting more than one trip. The Abbott Machine Co. are making a specialty of this process.

A Powerful Engine.

A rolling mill at Johnstown, Pa., has, perhaps, the largest and most powerful stationary engine in the country. It is located at works of the Johnstown Co., and is rated at 2,500 horse-power. It is of English manufacture, having been built by W. & J. Galloway & Sons. The two horizontal cylinders are each 44 in. in diameter and 48 in. stroke. The bed and frame are particularly massive, and the crank shaft, which is 17½ in. in diameter, is connected directly to the jointed shaft of the rolls. Each of the cranks with its journal was forged in one piece, and they are coupled at right angles. The movements of the engine, which is required to rotate the rolls first in one direction and then the other, are controlled by a steam reversing gear, which is operated from an elevated platform where the operator is in a position to view all the movements of the work below. It is a massive piece of mechanism and may well be rated among the notable engines of the country.—[Providence Journal.

Smoke Prevention in England.

The "black smoke" question, or, rather, the smoke nuisance, is now being dealt with in a practical way by a certain enterprising German engineer. This gentleman—according to Mr. Wigham Richardson, President of the Northern Institution of Engineers—is the proprietor of certain blast furnaces, and he is credited with having discovered a mode of conveying the gases from his furnaces into a chamber where they are washed with water spray, which causes every particle of soot or smoke to be deposited. Not only is the nauseous volumes of black smoke got rid of by this process, but, according to Mr. Richardson, a handsome profit is realized from the ammonia and sulphurous fumes yielded by the operation.—[Glasgow Engineer.

AMONG THE IRON MINES.

Lake Superior Mining Notes:—

MARQUETTE RANGE.

Not until very recently has there been anything of any magnitude done in the way of all-rail shipments from the Lake Superior fields to the big iron centers of the United States. There is now annually a large amount of ore that is forwarded to Chicago by all-rail, this being done principally in the Winter months, when navigation on the lakes is closed. With the new competition in the way of added railroads, there will be still further concessions made in the price of freight, and the Winter business will grow to an important one. The hard ores especially will be carried, as this character of the ore is free from the moisture of soft hematites and does not freeze so as to make its handling difficult. The Marquette district is the only one producing ores of the so-called "hard" variety in Michigan.—[Iron Ore.

ATICOKAN RANGE.

"Come with me," said Captain Garland to a South Shore mining man, "and I will show you more iron than you ever saw in your life in one place." An incredulous smile was the confident answer of the bright-eyed Yankee as he consented to undertake the journey. But he had met a man who was no blow-hard and who stood ready to show the goods. They traveled westward from Port Arthur along the line of the Port Arthur & Duluth railway, and, striking off into the forest at an angle to the railway, the captain took his companion to a vein of iron which made the eyes of the American sparkle with delight. "What do you think of that?" queried the captain. "Well, I confess you have kept your word," was the honest admission to Algoma's iron wealth. "Come half a mile further," said the captain, "and I will astonish you." They went on, says the Algoma *Pioneer*, and soon the captain placed his delighted companion before a mountain carrying a vein of rich magnetic iron sixty-five feet in width. This property is within a distance of sixty miles of the Port Arthur railway, and it is on the books of the company to run a branch line into the iron beds, and, in consideration of their doing so, a per ton royalty will be paid to the company. Port Arthur railway people have lots of capital, Algoma has boundless mineral wealth and "Jim Commee," M P P, is determined to develop some of it and reap a portion of the golden harvest therefrom. This magnificent property is in longitude 92 on the Aticokan river and less than sixty miles from the shore of Lake Superior. This is a sample of Algoma's "worthless (?) rocks," as they have been hitherto called.

MENOMINEE RANGE.

The Manganate mine is now where it was expected to be some time ago—at the point of shipping, but very little ore can be sent by water this year. Two derricks and a hoisting plant are in position at the open pit. The deposit of manganese at No. 1 shaft continues to improve and will no doubt yet prove the best part of the mine. The property will be in such shape next Spring that a very large output can be made—an output which will probably distance that heretofore made from any one mine in the district. The ore is there and the management knows its business.—[Diamond Drill, Crystal Falls.

The first shipment of ore from the new Crystal Falls mine was made yesterday, ten car loads being sent to Escanaba. The mining is being done from the open pit and there is very little stock room; mining has been rather slow, but now that they can make away with the ore mined, some tall work will be done. The foundation for the new hoisting plant is about ready for the machinery, which is daily expected. The open cut shows between 40,000 and 50,000 tons of ore, and everything in connection with the property is well in hand.—[Diamond Drill, Crystal Falls, Nov. 1.

An analysis of ore taken out of the shaft at the Baird exploration, at a depth of forty feet, showed over 63 per cent. in metallic iron and, to the surprise of everybody, only .090 in phosphorus. This demonstrates beyond question that the ore is gradually changing from non-Bessemer to a Bessemer. The ore taken out the shaft at a depth of from eight to 20 feet from the surface carried .400 of phosphorus, and the late analysis shows that the ore is constantly improving with depth. It is said that this was precisely the case with the Republic ore (which the Baird article closely resembles). A further reduction of only .015 in the amount of phosphorus carried would bring the Baird ore within the Bessemer limit, and it is highly probable that the percentage of obnoxious matter will fall even lower than .090 long before the shaft attains a depth of 100 feet.—[Florence Mining News.

GOGEBIC RANGE.

There is great rejoicing at the Ashland mine, and the citizens of Ironwood also have reason to feel elated over the discovery made at the mine. At No. 6 shaft, ore was discovered under the main dyke at a depth of 600 feet. Capt. J. H. Taylor, Superintendent of the Ashland, in speaking of the matter to a reporter of the *Advocate* said: "Yes, we feel elated over the discovery. It virtually proves that the Ashland and the other mines in the vicinity of Ironwood are almost inexhaustible. It will be of incalculable benefit to this city, assuring it of permanent prosperity and a rapid growth. The dyke under which we found the ore runs through the Ashland for its full length, and no doubt continues through the Norrie. Scientific men have claimed for a long time that ore could not be found under this dyke, but our discovery upsets their theory." This find will no doubt result in time in increasing the population of Ironwood to at least 15,000.—[Advocate.

The Montreal mine, which fairly pinched out in the old workings last Fall, has just shown up in a new shaft to be after all one of the big properties of the range. The owners became very timorous last Fall over the situation, and almost had a notion of giving the property up. Manager Abeil and Capt. Dan Sullivan, however, did not lose faith and induced the company to let them hunt for more ore, and sink a shaft to the northwest of the old workings. Different people would come along and tell them there was no use of hunting for ore at that spot, but they kept persistently at work, have got the shaft down four hundred feet, and within the last two months have gone down in to eighty feet of splendid blue hematite ore, than which there is no finer on the range anywhere between the Black and Potatoe Rivers. They have also crosscut a distance of eighty feet through this excellent ore, and the drift is still breasted in it. They have four hundred thousand tons of ore now in sight, and naturally feel elated over their success.—[Hurley Miner.

The *Times* says a number of Ironwood citizens have organized another mining company to be known as the North Brotherton Mining Co. They have secured an option on the eighty just north of the Brotherton mine at Wakefield and will begin work at once. It is intended to sink until the Brotherton vein is struck. The officers are Wm. Trebilcock, President; D. E. Sutherland, Vice-President; Gus Oleson, Secretary, and A. G. Hedeg, Treasurer. The board of directors are D. E. Sutherland, Wm. Trebilcock, Martin Kallander, Gus Oleson and Peter Johnson.

New American Iron Syndicates in Cuba;—

The Signa Iron Co, of this city, in which E. W. Clark & Co., the well-known capitalists, are largely interested, recently purchased 40,000 acres of mineral lands on the south side of Cuba, and it will soon begin active work in quarrying out iron ore for shipment to Philadelphia and other points in the United States. These lands are part of a mountain chain of iron ore of the finest quality which lines the entire coast from Cape Maysi to Santiago de Cuba, where the rich mines of the Juragua Iron Co. are located. The latter company is controlled by the Bethlehem and Pennsylvania Steel Cos., which use its product at the Bethlehem, Steelton and Sparrow Point furnaces. Outsiders have not the privilege of purchasing. The Sgua Co. proposes to build an immense breakkwater at Signa, directly on the coast, about twenty miles to the eastward of Santiago, so that vessels may be able to load without danger during any kind of weather, and thus save the expense of building a railroad and telegraph lines to connect with Santiago harbor. The tug George W. Pride, of Philadelphia, has been chartered to proceed to Savannah and tow to Signa and Santiago, three new barges to be used in carrying stone for the construction of the intended breakwater. The barges will take out a number of laborers.—[Philadelphia Record, October 30th.

The *Evening Wisconsin*, of Milwaukee, makes public the information that Charles L Colby, of that city, who is one of the owners of the fee of the Colby mine, is at the head of a recently formed company which proposes to engage in developing Cuban iron properties, and mining ore there for the American market. The new corporation is known as the Spanish-American Mining Co., and the *Wisconsin* says there is unlimited capital behind it. The ore from the mines which the company intends to develop and operate and put on the market is a very rich Bessemer, running as high as 65 per cent. in metallic iron, and the deposits are said to be extensive and lying so that they can be mined very cheaply. The particulars regarding the plans of the company will interest not a few of our readers: "The Cuban mines which Mr. Colby and his associates will operate are three miles from the ocean. The company owns land running from the mines down to a natural harbor. By building ore docks in the harbor, which is unimproved as yet, and constructing three or four miles of railway, the company could transport its own ore from the ocean. On the other hand, by the construction of several miles of road, the company's mines would be connected with a narrow gauge line which hauls ore from the same vicinity to Santiago. If this were done, the distance from mine to shipping port would be about 30 miles, but it is thought that cheaper ocean freights might be secured, as many vessels already touch at Santiago. The company, it is understood, has not yet decided which plan to adopt. It is the Spanish-American Mining Co. that has engaged the services of Captain W. D. Dickinson, formerly superintendent of the Commonwealth mine on the Menominee range, and more recently superintendent of the big Colby mine on the Gogebic range. Captain Dickinson has already arrived in Cuba. It is reported that the plans of the company will assume a more definite shape when Captain Dickinson completes a more careful examination of the property and makes a report."

Lake Superior Shipments of Iron Ore:—

Our weekly statement of ore shipments is not given to-day, for the reason that the report from Escanaba failed to reach us, and without the Escanaba report the statement would be so far from complete as to be of no value.—[Marquette Mining Journal.

The Most Powerful Electric Light.

An English paper says: "Usually we look to America for the biggest things on earth, but, strange to say, although the Americans are the most extensive users of electricity, the most powerful light in existence is the property of the British Government, and is to be found in the Isle of Wight. The lamp referred to is that of the light-house of St. Catherine's Point, where there is also a powerful fog horn. The plant has three engines of 36 horse-power each. Two of these are used for working the dynamos, and the other for the fog horn. The current is conducted by wires across a road direct from the dynamos to the lamps, there being no accumulators. The light is obtained from a carbon lamp of special pattern. The ordinary light is equal to 3,000,000 candles, but a light of 6,000,000 candle-power can be and has been obtained. It is impossible for any one who has not seen it to imagine the wonderful brilliancy of the light, but some idea may be formed from the fact that it can be distinctly seen forty-five miles away, and that at the Needles, fourteen miles distant, it is quite easy to read very fine print by means of the reflection. On one side of the lamp room is a quantity of very thick glass for repairing the windows broken, not by storms so much as by wild ducks and sea birds which are attracted by the light. A singular feature of the light house tower is a plummet and line hanging from the ceiling of a lower chamber, the plummet pointing to a spot on the floor. This is for the purpose of enabling the man in charge to tell when the tower is out of perpendicular. The light-house was built on an under cliff, formed by a gigantic landslip which occurred in 1799, and some portions of this cliff are still slipping."

IMPROVED PIPE FITTINGS.

The Isaac B. Potts Pipe Fittings Co., of Columbus, O., have recently placed upon the market a line of pipe fittings for connecting iron pipe without cutting threads, and lead pipe without the use of solder. The annexed cuts represent some of the improved pipe fittings:

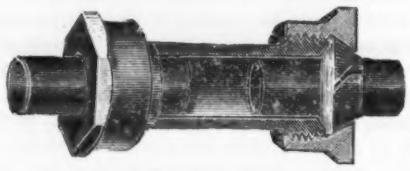


FIG. 1.—HERCULES PIPE JOINT.

Fig. 1 represents the Hercules pipe joint for coupling iron pipe without cutting threads, made in twelve sizes from ¼ inch to 2 inches, while above 2½ inches and upward to 12 inches are fastened together with bolts and flanges.

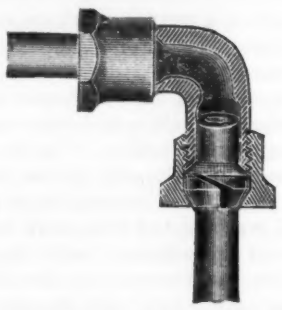


FIG. 2—COMBINED UNION AND ELBOW.

In Fig. 2 shows same principle applied to the combined union and elbow, and which is made in sizes from ¼ inch to 12 inches.

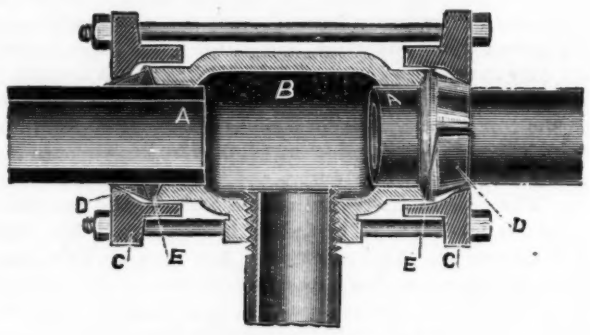


FIG. 3.—TEES FOR IRON PIPE.

A "T" for iron pipe is shown in Fig. 3 which can be put in without taking the pipe down, while Fig. 4 represents a well-designed cross.

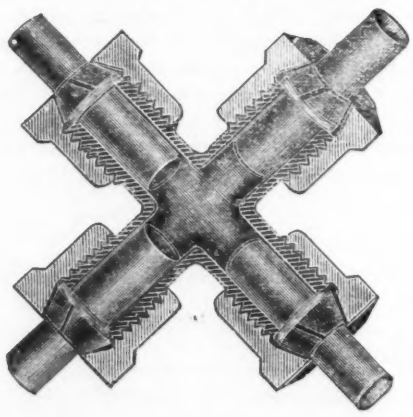


FIG. 4.—CROSS FOR IRON PIPE.

In Fig. 5 a view is presented of the combination Hercules and peerless pipe joint, which is used in joining lead to iron pipe without the use of either

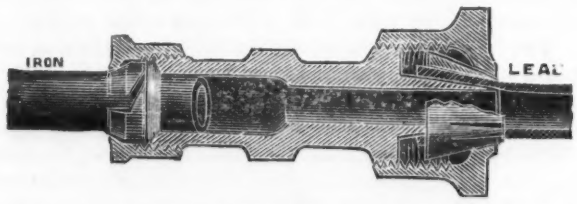


FIG. 5.—COMBINATION HERCULES AND PEERLESS JOINT.

solder or cutting threads. The joint is made in nine sizes from ¼ inch to 2 inches.

Figs. 7 and 6 for connecting lead and iron pipe, male or female, to take the place of water bucks, soldering union or the boiler coupling, made in nine sizes from ¼ inch to 2 inches.

Fig. 8 shows the peerless lead pipe joint, for connecting lead pipe without the use of solder. This is intended to do away with the wiping of lead joints or employment of skilled labor. After the ends of the pipes to be joined are cut, the coupling nut is passed over the end of pipe; next, with a rounded piece of iron, swedge the ends of the pipe to the proper form so that it will pass on to the cone of the fitting, with a knife cut the pipe line to the ring,

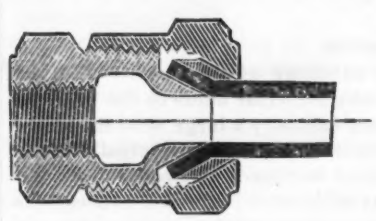


FIG. 6.

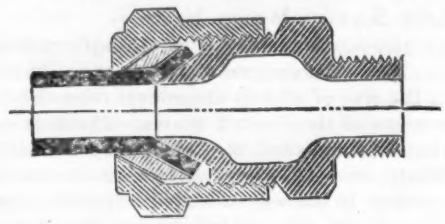


FIG. 7.

then screw the nut up tight and you will have a perfect joint. This is found a great convenience, saves both time and expense.

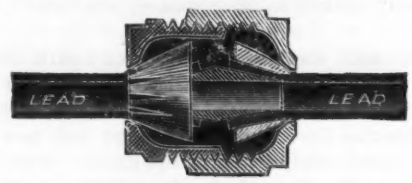


FIG. 8.—PEERLESS LEAD PIPE JOINT.

Fig. 9 represents the principle of the lead pipe connections applied to tees, being a casting with three connections for lead pipe.

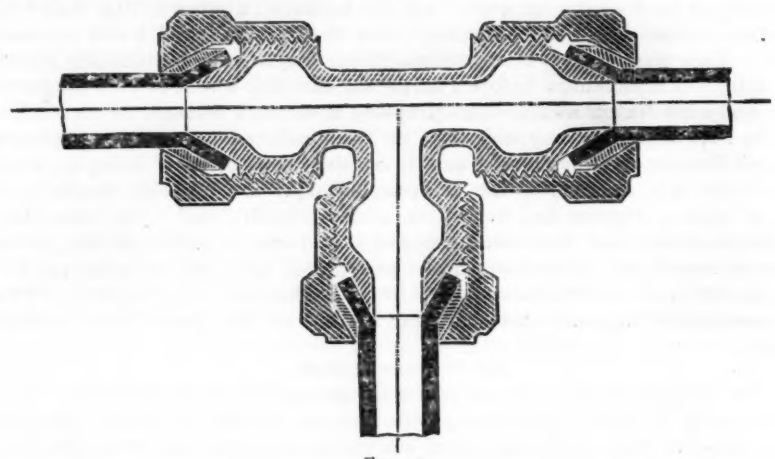


FIG. 9.

The pipe fittings manufactured by this company are made of cast or malleable iron, galvanized or tinned, and of rough and finished brass and are made to stand any pressure, and are being used throughout United States and Canada, and are giving satisfaction wherever they are properly applied. For full particulars and catalogues of other patent fitting, patented by them, address Isaac B. Potts Pipe Fittings Co., 306 N. Hight street, Columbus, O.

Production of Bessemer Steel Ingots and Rails in the First Half of 1890.

The following table, taken from the *Bulletin* of the American Iron and Steel Association, shows the production of Bessemer steel ingots in the United States in the first half of 1890, compared with the production in each half of 1889. The production of steel ingots by the Clapp-Griffiths and Robert-Bessemer processes is included; we also add a statement of the ingots produced by the Clapp-Griffiths process alone. The production of Robert-Bessemer steel was very small:

Ingots.	First half of 1889. Net tons.	Second half of 1889. Net tons.	First half of 1890. Net tons.
Pennsylvania	930,748	1,042,797	1,254,029
Illinois	245,171	491,830	372,975
Other States	244,796	323,487	389,021
Total	1,420,715	1,851,114	2,015,925
Clapp-Griffiths only	38,356	44,494	39,469

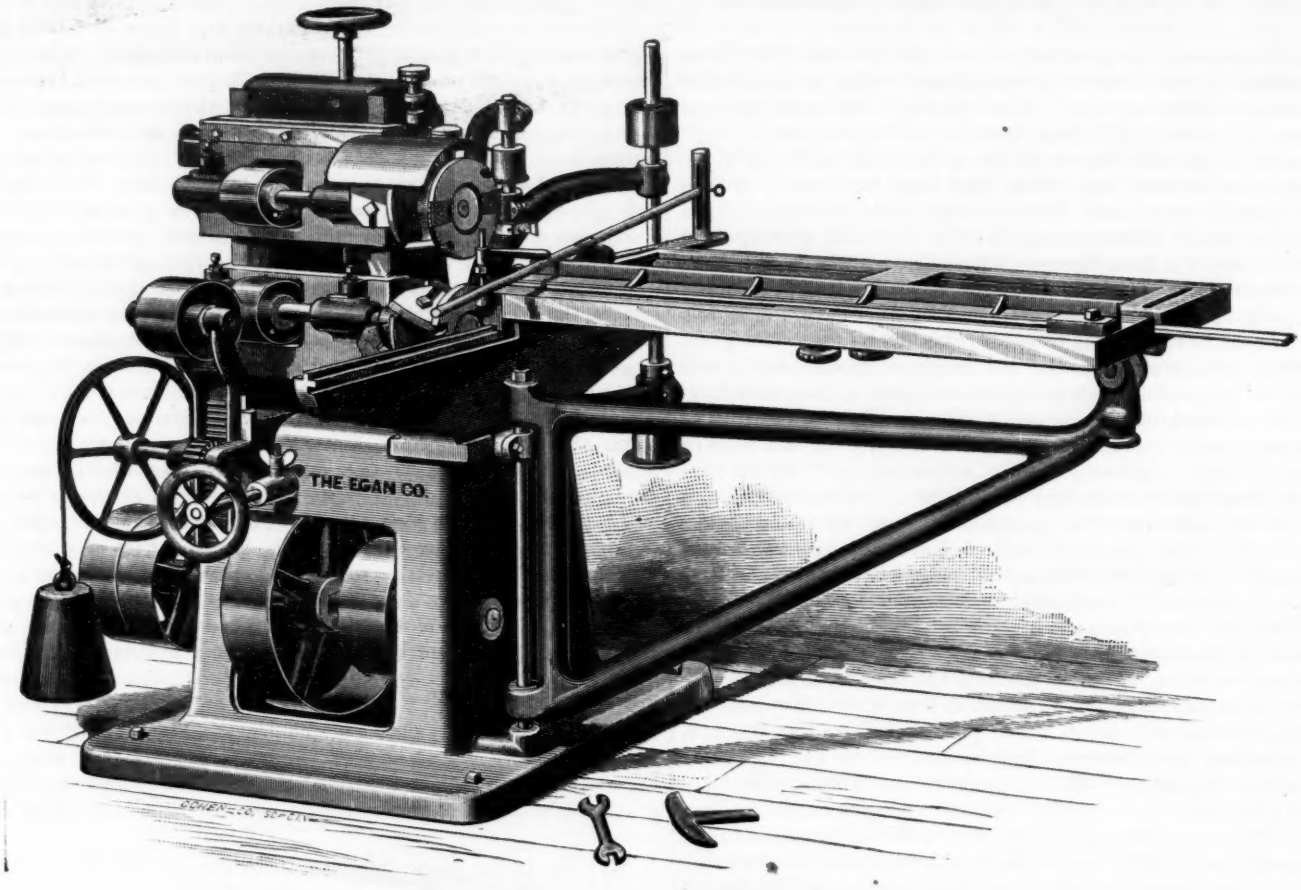
The following table shows the production of Bessemer steel rails of all kinds and sizes in the first half of 1890, compared with the production in each half of 1889. In this statement we do not include the Bessemer steel rails which were rolled in iron rolling mills from purchased blooms:

Rails.	First half of 1889. Net tons.	Second half of 1889. Net tons.	First half of 1890. Net tons.
Pennsylvania	523,882	578,569	738,931
Illinois	179,201	342,853	279,407
Other States	16,489	5,705	25,916
Total	719,572	927,127	1,044,254

H. K. PORTER & CO., at their Light Locomotive Works, at Pittsburgh, have just shipped to the Otis Steel Co., of Cleveland, the smallest locomotive they have ever built. Some of the dimensions of this locomotive are as follows: Cylinders, 5 inches diameter by 10 inches stroke; four driving wheels 22 inches in diameter; total weight in running order about 7,000 lbs.; two rear tanks arranged to form seats for the engineer and holding 100 gallons of water. The gauge of track is 23 inches, and the engine passes round curves of only 19 feet radius. There is no cab, as the engine is only used inside the mill. The total length of the machine is about 9 feet.—[National Car and Locomotive Builder.

NEW NO. 3 TENON MACHINE.

We take pleasure in presenting to our readers an illustration of the newest mechanism in the tenon machine line which has just been brought out by the Egan Co., Cincinnati, O. This tool has special advantages not usually found in machines of this class, and which will recommend it to practical men everywhere. It is justly meeting with a large and increasing demand for it is well built in every way and is claimed to have the highest efficiency yet attained. We describe it is follows: The cut represents a newly designed extra heavy tenon machine, with double heads and two copes, especially presented to the planing mills as by far the best tenon machine now in the market, and having superior advantages and conveniences for sash and door work, planing mills and other general wood workers. The frame is cast whole, the main part being on a pedestal, and it stands more solidly than a machine on which the



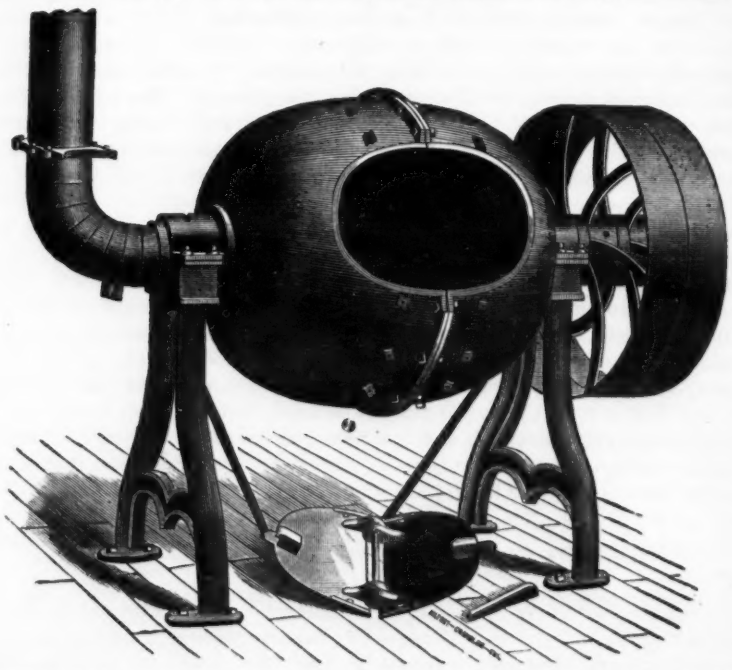
NEW NO. 3 TENON MACHINE.

legs are bolted. It will cut tenons from ¼ to 7 inches long, and the heads can be adjusted to any thickness. The mandrels are of steel, and run in self-oiling grooved boxes, and the lower half of box being cast on the mandrel or yoke, makes a very reliable bearing. Tightening on the caps or boxes takes out all end motion or vibration on the heads, thereby causing them to do smooth and perfect work. The table is light, and very stiff and strong. It is easily and quickly handled, and has the extension bar with two stops adjustable to any length of tenon. The swinging support for the outer end of table is their latest improvement, and is arranged so that the operator can walk clear beyond the heads in cutting the tenon; on wide tenons this is a great advantage, as the operator can follow up and does not lean over so much. The table is gibbed on under side of slide next to frame, and by no possible accident can it be thrown into cutter heads, and the outer end being on a swiveled roller, the motion is far easier and steadier than made in any other way. The upper cutter head, with its mandrel and frame, can be moved laterally so as to cut longer tenons than the lower if wanted. Saw spurs are used on heads, and the shear cut made by these heads is first-class. The cope heads can be adjusted both ways, and are driven with very long belts, thus preventing all slippage or falling off of belts. The main driving belt runs between boxes and has full clearance, and can be made endless, as the tightener holds belt always taut, and keeps it so closely hugged to spindle pulleys that there is no slipping, even when doing the heaviest kind of cutting. For further information address the manufacturers, The Egan Co., Nos. 251 to 271 West Front street, Cincinnati, O.

The congratulations of two continuents will be extended to *The Century* upon the advent of its twentieth anniversary. No more conspicuous example of American literary enterprise is to be found than that shown by *The Century*. In keeping with the spirit of progress thus shown its November issue is more than usually rich in illustrations, and attractive in literary contributions. An article of especial interest is one by Theodore L. De Vinne, of the De Vinne Press, showing the progress in printing during the past twenty years. The great feature of *The Century's* new year, the series on the Gold Hunters, is begun with John Bidwell's paper, fully and curiously illustrated, on "The First Emigrant Train to California." Another important series of papers herein begun is Mr. Rockhill's illustrated account of his journey through an unknown part of Tibet, the strange land of the Lamas. A notable and timely contribution to Dr. Shaw's series on municipal government is his interesting and thorough account of the government of London, with its warning for American municipalities. A pictorial series begins in this number—"Pictures by American Artists,"—the example given being Will H. Low's "The Portrait." The first of two article on the naval fights of the war of 1812 appears in this number.

THE STOVER EXHAUST TUMBLING BARREL.

This tumbling barrel is egg-shaped. It has a section of exhaust pipe connected to the hollow journal at one end, and a tight and loose pulley at the other end. No gearing whatever is used. Three special advantages are found in the egg shape. It gives the contents a double motion or action—from ends to center and from sides to center—causing a thorough mixing and rubbing together of all the parts contained therein, cleaning and polishing the contents better and quicker than any other form of barrel. This tumble requires less power, as the end motion causes the contents at ends to tumble into the centre because of assuming the perpendicular earlier than those parts at the sides. It runs with less noise because the contents are kept moving in two directions at the same time, doing away entirely with the intermittent motion so noticeable in other forms; doing away with gearing also lessens the noise. The Stover is linedwith a sectional lining of hard iron, which can be cheaply and quickly replaced when worn out, making the



barrel as good as new. Diameter for pipe, 5¼ inches; diameter inside of barrel, 27 inches; length over all, 4 feet 8 inches; length between bearings, 3 feet 2 inches; pulleys, 4½x30; height from floor to center, 2 feet 8 inches; opening in barrel 13x19 inches; speed, 45 revolutions per minute. For further particulars, address J. C. Smith & Co., general agents, Cincinnati, O.

THE construction of the railway between Wady Halfa and Sarras is progressing rapidly, and the line will be completed by the end of the year.

THE METAL OF THE FUTURE.

The interest recently awakened in aluminum is justifiably great. Indeed, it is doubtful if any other discovery now thought probable would so thoroughly revolutionize industry as would the discovery of how to make aluminum cheaply. The supply of ore is immense. That word is used in its literal sense of "immeasurable," for aluminum is everywhere about us. As a metal it has qualities that make it a most desirable substance for almost all purposes for which other metals are now used. It melts at red heat, and can be cast in molds. When cast it is as soft as silver, but it can be hammered or rolled to become almost as hard as iron. It can be drawn into wire as fine as a spider's web, or beaten into leaf as thin as gold. Neither air nor water affects it, for it neither tarnishes nor rusts. It can be alloyed, or made into a bronze, so that the composite metal will have a transverse strength equaled only by the finest quality of crucible steel, and a tensile strength greater than that of any other metal. Most important of all, it is far lighter than any of the metals now in general use.

Imagination shrinks from the possibilities of such a metal. We point with pride and wonder to the advance in civilization during the nineteenth century made possible by steam and coal. Electricity and aluminum may put the twentieth century as far ahead of this as this had the eighteenth.

Though aluminum is plentiful the existence of its oxide has been recognized only since 1754, and it was 70 years from that time before any of it in separate form was actually produced. For 30 years more it attracted little attention, but in 1855 a French chemist mastered the secret of getting it in compact form, since which time investigators in every part of the world have been working at the problem of cheap production. It has not been found hard to produce it, judging by the number of inventors who have succeeded, but it has been found next to impossible to get it in useful shape. The great difficulty is the strong affinity of the metal for the elements with which it is combined. Its physical properties, such as tensile strength, malleability, flexibility, etc., are greatly affected by the presence of even small quantities of foreign substances, especially silicon and iron, and the trouble has been to separate these. The methods commonly used in extracting gold, silver, iron and lead have for this reason failed utterly when applied. It has been learned that any economical and considerable production must be made either chemically or electrically. The chemical methods have most adherents, and it is by one of them that a Chicago experimenter says he will reduce the cost to much less than 15c. a pound. The details of his process are, of course, secret, but it is asserted that the process is surprisingly cheap and easy. It is proposed to get the metal from clay—from 600 pounds of it 100 of aluminum. If these claims are realized the reduction in cost will indeed be marvelous. For years the market price was about $10 a pound, and most of it was made in France. Then English inventors brought the price down to less than $3, and within five years American manufacturers have come into the market. The announcement of the Chicago project resulted in a big drop in the price.

At the previous price the metal was fast coming into mercantile use, and at $1 a pound it bids fair to become really common. It must be remembered that at $1 a pound aluminum is not nearly so high as it looks, for the relation of a pound of aluminum to a pound of other metals is something like that of the famous pound of feathers to the pound of lead. Aluminum is almost three times as bulky as iron, weight for weight; it is more than four times as bulky as silver, and more than seven times as bulky as gold. Thus, if silver were $1 an ounce and aluminum $1 a pound, silver would be really fifty times the more costly, bulk for bulk; aluminum at $1 a pound would be only twice as costly as copper at 15 cents a pound.

As a conductor of electricity, aluminum compares favorably with copper, and it is already in great demand for electrical uses. It is in this direction that it is most likely first to find general application. Next will doubtless come its use in connection with transportation, both by land and sea. Arrangements have already been made to construct railway cars with it, and reduced cost is sure to make it common for this purpose. The saving in dead weight, and, consequently, both in the cost of power and in wear and tear, will be enormous. In shipbuilding there will be even greater gain, for it will reduce by two-thirds the displacement and proportionately increase the tonnage capacity.

Aluminum has already been put to extensive use for alloys. Even very small percentages added to iron, steel, copper, etc., improve their quality remarkably. The most common alloy is that with copper, making what is known as aluminum bronze, consisting of pure copper and 2½ to 10 per cent. of aluminum. As the percentage of aluminum increases, there is a proportionately much greater increase in the hardness. While the 2½ per cent. bronze is very easily worked, and even the 5 per cent. can be easily forged, rolled and drawn cold, the 10 per cent. is so hard that it is unexcelled for all purposes where great strength and resistance to wear and tear and to rust are desirable. Indeed, its great hardness and homogeneousness make it an excellent metal for ordnance.—[Bradstreet's.

BRITISH CAPITAL IN THE UNITED STATES

Current circumstances appear to be favoring a large investment of British capital in the United States. There was a tendency a few years since on the part of well-to-do Englishmen to invest in American land, but such a system as this is decidedly disapproved by the American people and by Congress and the State Legislatures. It is not so very long since that Congress passed an act prohibiting the ownership of land by aliens in the territories of the United States. The territories, it should be observed, are not organized States, but are under the control of the General Congress, to which they send deputies. It is necessary accordingly for Congress to legislate specially for them, as they have no Legislature of their own; and this being the case, Congress took very good care three or four years since that no land in the territories should be owned by Englishmen or Europeans. Many of the State legislatures have adopted a similar policy, as there is a strong feeling against anything like absentee landlordism. But there is no such feeling against the investments of British or European capital in American industries, and of late many American undertakings have been bought up by British syndicates or companies. Two circumstances appear especially calculated to encourage the further development of British investments in American undertakings. The first influence which has assisted this development is the visit of a numerous delegation of the members of the Iron & Steel Institute to the principal centers of American metallurgical industry. The second influence which is at work is the new protectionist tariff which has just been enforced by Congress. The United States have long been more or less a protectionist country, but this month the Americans may be said to have outheroded Herod. The protectionist screw has been turned so much tighter that many articles of European manufacture will be virtually excluded altogether from American markets.

There are, practically, three parties and three divisions in the American Congress, especially as regards commercial and fiscal legislation. Ostensibly, there are only two parties in Congress—Republicans and Democrats—but when Congress has to deal with tariff matters, three parties may be said to appear upon the scene, viz.: the North, the South and the West. The Northern States have long held protectionist views, and the industrial development of the South has rallied that section also to their side. The West has been thus left without any ally, and has been unable to prevent the passage through Congress of a protectionist measure of a most drastic character. While the McKinley Bill will undoubtedly have the effect of bolstering up—at any rate, temporarily—the manufacturing industries of the Northern and Southern States, the Western States, which are almost entirely agricultural, will have to pay the piper. In other words, if a Western American railroad company requires to purchase railroad *materiel*, it will be more than ever at the mercy of Northern and Southern rolling mills and iron works. But, whatever the effect of the Bill may be upon the Western States, it is none the less binding upon the whole American Union, and its enactment may be urged upon British capitalists as another reason why they should embark a portion of their funds in the now over-protected industries of the Atlantic States.

It is true that the McKinley Bill establishes the protectionist system more firmly than ever in the United States, but the effect of protection is, after all, to enervate the industries which it is intended to benefit. A "protected" industry always bears a more or less close resemblance to some exotic in a hothouse. The exotic thrives after a fashion, but it does not possess the robust vitality of some plant which blooms unaided in the open air. Moreover, the protectionist system of the United States may not last forever. The power of the Western States may increase in Congress; and if it does, the West may prove more than a match for the North and the South together. The consuming classes of the Northern and Western States may also grow tired of having to pay unnecessarily high prices for "protected" manufactured goods.—[Colliery Guardian, London.

THE TRUE STATUS OF THE PITTSBURGH GAS SUPPLY.

SPECIAL CORRESPONDENCE.]

The sensation of the week has been the action of the Philadelphia Co. shutting off the natural gas from the puddling furnaces that they have been supplying. While this will unquestionably have a marked effect on the iron industries of the city, yet the impression that has gone out exaggerates the actual situation from the fact that the furnaces that depended on this company were but a small proportion of the actual number that are using gas. A large number of the larger concerns own their own pipe lines and are having no trouble; neither are the firms that were depending on other gas companies for their supply. The large number of new gas wells that have been struck recently would indicate that the supply is far from being exhausted, but the difficulties in the way of getting the gas from scattering wells are great, though far from being insurmountable. The result, however, will be the return to the use of coal by some firms for the time being, and the gradual adoption of some form of fuel gas, by those firms that do not have gas wells of their own. The shortage of gas for even domestic use during the past two weeks, which was followed by an increase of fifty per cent. in the price, this in turn being followed by a full supply of gas in the houses, gives color to the assertions of many that the main object of the company was to have an excuse for raising the price of gas for domestic use, though it is certain that the order shutting off the puddling furnaces will not be rescinded. The best estimates given give the amount of gas consumed in a puddling furnace making five heats in ten hours at from 40,000 to 50,000 feet. As there are 993 furnaces in the city it will readily be seen that the amount of gas consumed was simply enormous.

A big iron works at Christy, near McKeesport, is one of the rumors of the street.

Park Bros. are taking steps to bring the gas from the Wildwood gas fields to the city, having contracted for an 8-inch wrought iron pipe to be laid and ready for use before the first of January, 1891. The line will be eight miles long.

The Edgar Thomson Steel Works report an output, in October, of 32 300 tons, 2,000 tons better than they have ever done before.

The Portage Lake Canal.

The Portage Lake canal, originally a private enterprise, is to be sold to the Government, and will, with its connections, be widened and deepened, furnishing a channel for the largest vessels, and enabling them to avoid the detour around Keweenaw Point, the most dangerous piece of navigation on Lake Superior. The works purchased include two canals, one five miles in length and connecting Lake Portage with Lake Superior on the east, the other 2⅛ miles long and making the connection to the westward.

A BIG IRON FIRM'S FUEL SUPPLY.

The iron and steel works of the Cambria Iron Co., observes the *Coal Trade Journal*, draw upon widely separated parts of the country for the raw materials used. The coke comes from the Connellsville coke region in Fayette county, the limestone from Blair county, and the iron ore from the Menominee iron ore range of Michigan.

The principal coke works of the company are in the Connellsville field, and are as follows: Atlas, 80 ovens; Mahoning, 100; Morrell, 400; Wheeler, 100 ovens; total 680 ovens. These have an annual capacity of 390,000 net tons of coke, requiring 557,000 tons of coal. The coal is all mined below water level by slopes which follow the seam down from the outcrop. The seam varies in thickness from 7½ to 9 feet, and is almost free from slate and other impurities. Its dip is about 6° in a westerly direction. This coal makes a hard, bright, silvery coke, with well-developed cells, making it a most superior blast furnace fuel.

At Bennington, on the summit of the Allegheny Mountains, 28 miles east of Johnstown, the company own 100 coke ovens, the output of which is used at the Hollidaysburg blast furnaces. The coal here used for coke is mined from what is locally known as the Lemon seam. It is the Upper Freeport bed, or "E" seam of the coal measures. It is from 4 to 4½ feet thick, lies about water level, and dips westerly about 2½°. The coke produced is of an excellent quality, but it is not considered to be quite as valuable a fuel for metallurgical purposes as Connellsville coke. The Bennington works can produce annually 55 800 net tons of coke, requiring 90,000 net tons of coal. There is also mined at Bennington about 40,000 net tons annually from the Lower Kittanning or "B" seam, for steam and blacksmith purposes.

Previous to the introduction of natural gas into the Cambria Iron Co., in October, 1886, the company operated the following mines in the vicinity of Johnstown, to supply the mills and works: Rolling Mill mine, annual capacity, 217,000; Coshun mine, annual capacity, 56,000; Lower Gautier mine, annual capacity, 30,000; Woodvale mine, annual capacity, 10,000; Conemaugh mine, annual capacity, 30,000. The Rolling Mill mine, the principal source of the coal supply, is in the Cement or Upper Kittanning seam, known as the "C" bed of the lower coal measures. The seam is about 3½ feet thick, lies very flat, and is about 60 feet above the Stony creek.

The mine workings are very extensive, the area now mined out being 660 acres. There is an immense territory adjacent to the mine, which can be determined upon to furnish a large amount of coal for many years. The Coshen mine, situated opposite Woodvale, and nearly 200 feet above the Little Conemaugh river, now produces 200 tons of coal per day, for the use of the Gautier works. Here the Upper Freeport seam or bed "E" of the coal measures is worked. It is about 4½ feet thick, and affords an excellent seam coal. Lower Gautier and Woodvale mines, in the Lower Kittanning or "B" seam, immediately under the Coshun mine, are small mines that have been closed since the introduction of natural gas.

Propellers to Produce a Speed of Twenty-five Miles an Hour.

An ingenious mechanic in Bridgeport, Conn., Mr. James Hamilton, has finished a fine working model of an entirely new method of adjustment of propellers for ocean steamships. It consists of three great horizontal shafts lying parallel to each other and extending outward from the stern of the vessel. To each shaft a three-blade screw propeller is attached, the central or middle one being in area just twice that of the other two propellers. Within the vessel the three shafts are joined transversely with strong rods and have clamps attached so that one or all can be instantly detached if necessary. A triple expansion engine of great power is to run each shaft.

The inventor claims his system will give a more uniform motion and with the same horse-power exerted by the engines will give far greater results. In other words, if 10,000 horse-power exerted on two propellers gives a vessel a speed of 20 miles an hour the same power exerted on three propellers will give 25 miles an hour. Another important point with the invention is the many resources it possesses in case of a break-down. When at sea the breaking of a shaft or part of an engine is often a serious matter. In this device there are nine combinations which can be made to run the ship. This may be better understood by saying that the three engines and the three shafts must each be broken or disabled to put the ship in a helpless condition. If one or even two shafts should break the combined horse-power of the three engines can be thrown upon or applied to the remaining shaft and the speed be not greatly diminished. Should one or two engines break down the remaining engine can still run one, two or three propellers.

Cleaning Machinery.

The simplest and most efficacious method of thoroughly cleaning the various parts of machinery that have become gummed and dirty by the use of fat oils for lubricating purposes is by using a strong soda lye. For each 1,000 parts by weight of water take about 10 or 15 parts by weight of caustic soda or 100 parts ordinary soda. Let the solution boil and enter the parts to be cleansed; either boil them in this lye or let them steep in it for some time. All the dirt and oil resin is completely dissolved thereby, and it remains only to rinse and dry the parts. The action of the lye is such that it enters into combination with the oil and forms soap, which is readily soluble in water. In order to prevent the hardening of the lubricant on the machinery parts, it is only necessary to add about one-third kerosene. An occasional lubricating with kerosene alone is to be recommended.—[American Engineer.

Smoke Prevention.

The Society of German Engineers has arranged to offer two prizes of $720 each for the best papers on smoke prevention, one for steam boilers, and one also for domestic furnaces, with additional prizes of $240 for drawings.

INDUSTRIAL SUMMARY.

New Enterprises:—

The Rockbridge Co. are negotiating for the establishment of nail works at Glasgow, Va.

The Valley Machine Co. has been organized at Saginaw, Mich., with a capital of $30,000.

A new corporation, at Columbus O., is the Minot Electric & Machine Co. with a capital stock of $50,000.

The Rigby Safety Car Wheel Co. is a new organization at Detroit, Mich., with a capital stock of $500,000.

It is said the Griffin Car Wheel Works, of Buffalo, N. Y., contemplates erecting car wheel works in Middlesborough, Ky.

The Atlas Iron & Brass Works is a new institution at Duluth, Minn., that will employ 200 men in operating a plant that will cost $75,000.

The James P. Montgomery Balance Pump Manufacturing Co. have organized, with a capital stock of $100,000, to do business at Pueblo, Col.

It is stated that C. M. Clark, Mr. Seaman, of Wilmington, Del., and others will build a rolling mill and horseshoe works at Max Meadows, Va.

The Beedle & Kelly Co., of Muskegon, Mich., has been chartered for the purpose of manufacturing implements and machinery; capital stock, $100,000.

The Rounds & Anderson Foundry Co. has purchased 25 acres of ground in Chicago, on which it will at once erect works which will employ 1,200 men.

The Inter-Ocean Boiler Co., capitalized at $100,000, have filed articles of incorporation at Duluth, Minn. The company will manufacture the Hazleton boilers.

The Holmes Tripod Boiler Co., at Duluth, Minn., has been organized, and it will build a plant that will cost over $80,000, which will give employment to 200 men.

Frank Tyman, E. M. Nettleton, W. A. Rhinehardt and others are understood to have secured a site, and will erect a foundry and machine shop at Covington, Va.

The United States Spring Co. has been incorporated at Chicago, Ill., to manufacture springs; capital, $50,000; incorporators, C. S. Leed, Sam S. Hale, Charles N. Hale.

Twenty acres of land and a subsidy of $35,000 have induced the Indiana Steel Co. to locate its plant at Wabash, Ind. The company is reported to have a capital stock of $500,000.

Thomas E. Barrow, John Creigh, of Mansfield, O., and A. B. Small, of Macon, Ga., will probably organize a $50,000 stock company, to manufacture the mower, patented by J. M. Hunt, of Round Oak, Ga.

The McCloud Iron & Steel Co., of Chicago, has been incorporated by S. McCloud, F. G. Holton and W. D. Crossman. The company will manufacture iron and steel articles for railway use. The amount of capital stock is $100,000.

The Liggett Spring & Axle Co., of Pittsburgh, Pa., have recently been granted a charter. The following are the directors: William G. Park, Jacob B. Decker, of Allegheny, Pa.; and Charles E. Clapp and George Wright, Jr., of Pittsburgh, Pa.

Among recently incorporated Chicago concerns is the Rogers Oil Cup Co., which proposes to manufacture and deal in lubricating inventions and patents thereon; capital stock, $50,000; incorporators, Eugene M. Farr, Thomas J. Rogers and Thomas M. Fish.

A corporation, to be known as the Lynn Lasting Machine Co., has been organized at Saco, Me., for the purpose of manufacturing lasting machines. The company has a capital stock of $500,000, and its officers are: President, William Shephard, of Lynn, Mass.; Treasurer, A. M. Preble, of Lynn, Mass.

The first malleable iron works to be established northwest of Chicago has just been located on Concord street, St. Paul. A lot 100x120 feet, with buildings has been donated. The works will employ at the beginning about 25 or 30 hands. It has already received orders ahead for several hundred sets of castings.

The McKay Plant-Setter Manufacturing Co. has been organized at Lynchburg, Va., with W. H. Wren, President; H. E. McWann, Vice-President, and James D. Tate, Secretary, to erect a factory for the manufacture of the McKay patent plant-setter. The company will, it is stated, establish malleable iron works in connection with the same, and will have a capital stock of $500,000.

The Richmond Sash Holders & Malleable Iron Novelties Co. has been organized at Richmond, Va., with $50,000 capital stock. The company own a patent on a sash holder, adapted to railway car windows. The plant will be erected at once. The officers are: S. W. Bowman, President; A. D. Wilkinson, Vice-President; John J. Mayer, Treasurer, and George Crutchfield, Secretary.

A proposition has been made to the Omaha Board of Trade, of Omaha, Neb., by A. J. Sweeney & Son, machinery builders, of Wheeling, W. Va., looking to the starting and operating of a wire nail plant in Omaha. The firm propose to invest a large sum of money in the enterprise, and operate the plant successfully for five years under certain conditions. They propose to lay out a plot of 240 lots, for which they will ask the Omaha Board of Trade to find purchasers. As soon as these lots have been sold they will commence work on the plant, which, it is claimed, will pay out about $100,000 per annum, and employ about 100 men.—[Iron Age.

Enlargements, Additions, Removals, Etc.:—

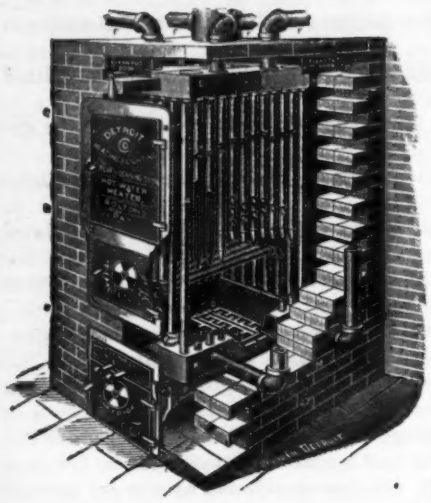
The Dixon Car Wheel Co. has enlarged its foundry at Houston, Tex.

The Eagle Iron Works at St. Louis, Mo., contemplate adding more machinery to their plant.

E. M. Ivine, of Grand Haven, Mich., has made a proposition to organize a $50,000 stock company for the removal of his iron works plant to Aberdeen, Miss.

An interest in the stove foundry at Defiance, O., has been purchased by R·

BOLTON



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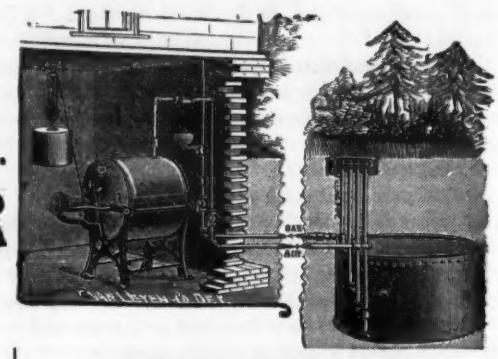

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Over 20 Years in use, with never an Accident.

Average cost of gas, ½ cent per hour per burner.

M. Whipple, a wealthy Chicago man, who proposes to enlarge the plant and increase the number of hands.

It is reported that the nail factory of the Sharon (Pa.) Iron Works may soon be changed into a sheet mill.

A new puddling furnace with a capacity of 15 tons per day has been erected at the Wheatland mill in Youngstown, O.

The Briesenick Foundry & Machine Works will, it is stated, rebuild its foundry and machine shops at Brunswick, Ga.

The Louisville (Ky.) Pipe Bending Co. will enlarge its works and put in heavier punch and shears, also rolls for boiler work.

The Ryan-McDonald Manufacturing Co., of Waterloo, N. Y., will remove its machine works to Curtis Bay, near Baltimore, Md., and incorporate a $100,000 stock company to operate them. A building 70x350 feet is to be erected.

The Rochester Machine Screw Co., Rochester, N. Y., are erecting an addition to their factory which is to be completed in November, and in which they expect to be before January 1, 1891. The building will be of brick, four stories high, including in this number the basement.

The Oswego Machine Screw Co., of Oswego, N. Y., have moved their machinery, etc., to Cortland, N. Y., and will be reorganized under the name of the Cortland Machine Screw Co. They will employ from twenty to thirty men at the start, and will soon increase their force.

Furnaces and Works Starting Up:—

The Thomas Iron Co.'s second Saucon furnace at Hellertown, Pa., has been blown in after thorough repairs.

No. 1 stack of the Woodstock Iron Co., Anniston, Ala., has gone into blast after all idleness of several months.

The Newberry Furnace, at Newberry, Mich., was blown in on October 20, after being out of blast thirty days for repairs.

The Lockhart Iron & Steel Co., of Pittsburgh, has completed the repairs at its mill at Chartiers, and the mill is again in operation.

The Enterprise Boiler Co., of Youngstown, O., having completed the building of the blast furnace at the Thomas furnace plant, at Niles, O., it will be blown in this week.—[Youngstown (O.) Telegram.

Fires and Accidents:—

Incendiary fire on the night of Nov. 2 destroyed the blacksmith shops of the Santa Fe Road, at Fort Madison, Ia., entailing a loss of $20,000; insurance, $7,000.

The D. F. Morgan boiler works burned Nov. 2, at Akron, O., with a loss of between $35,000 and $40,000. It was incorporated last March with a capital of $100,000, but was insured for only $8,000. The origin of the fire is not known. The J. McNeil boiler works have been rented till a new building is erected.

General Industrial Notes:—

Messrs. H. E. Collins & Co., of Pittsburgh, Pa., the well-known iron and metal firm have opened an Eastern office at Aldrich Court, 45 Broadway, New York City.

In the equipping of railroad shops The Egan Co., of Cincinnati, O., are having rematkable success, only entering this field a year ago. They have just received an order from the Southern Pacific Co. to fit out their new shops at Vicksburg, Miss., with the necessary machines for car building.

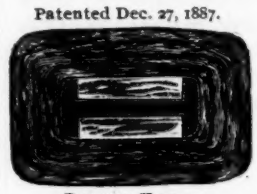
I. H. Day & Co., successors to the Hunter Manufacturing Co., Court, Broadway and Eggleston avenue, Cincinnati, O., have issued a catalogue and price list of special machinery. Among the specialties which this company manufacture are Hunter's lightning sifters and mixers, fruit cleaners, egg and sponge beaters, grinding mills, emulsifiers, paint mixers, etc.

Mandrel Rolled Hollow Stay Bolts.

The process of making these hollow stay bolts is as follows: Two pieces of iron rolled in U-shaped section are laid together and wired in that position. These parts are then heated to a welding heat and run through rolls. As the welded tube comes from the rolls it passes over a mandrel, which fills the interior. Before reaching the second pair of rolls it cools slightly and shrinks upon the mandrel. In the second pair of rolls it is drawn from the mandrel and the interior cleared from slag and cinder. In this way, by five repeated operations, a hollow stay bolt is obtained which has a uniform interior diameter. The material is Tenessee bloom charcoal iron, and is made in lengths of about six feet. The advantages of hollow stay bolts are well understood. A considerable saving in expense can be made by using hollow stay-bolt iron instead of drilling the ends of the bolts after they are in position. However, it is necessary that the very best material be used for all kinds of stay-bolts, and it is claimed by the manufacturers of this bolt that they do get the best material because of using a superior quality of iron and an improved process. These bolts are made by the Falls Hollow Stay Bolt Co., Cuyahoga Falls, O.

STILL ON TOP.

Patented Dec. 27, 1887.



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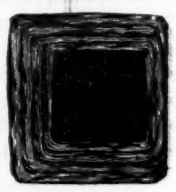

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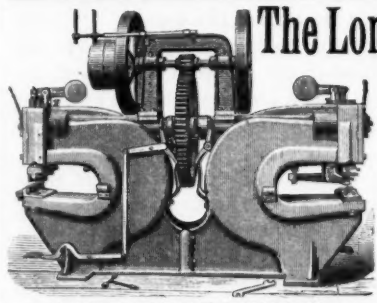

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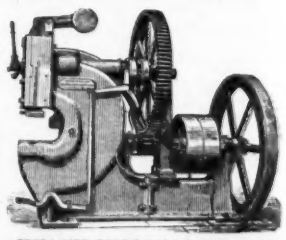

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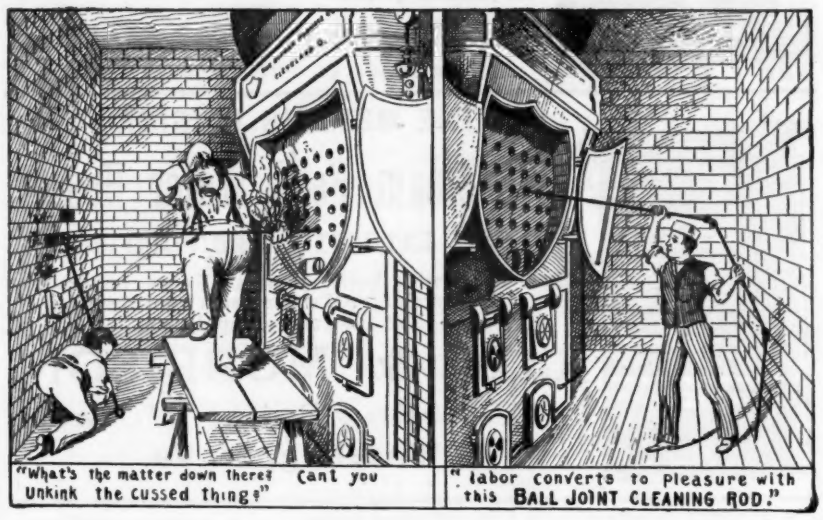
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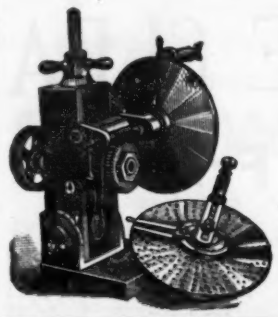

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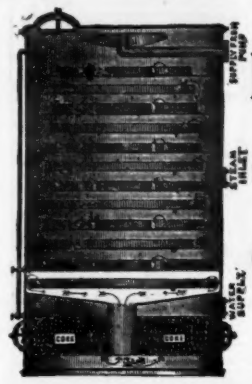

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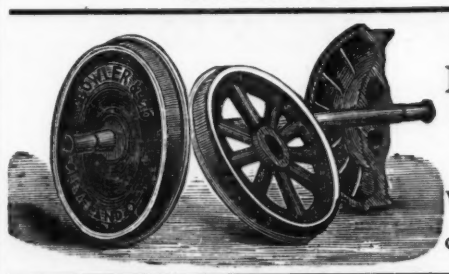

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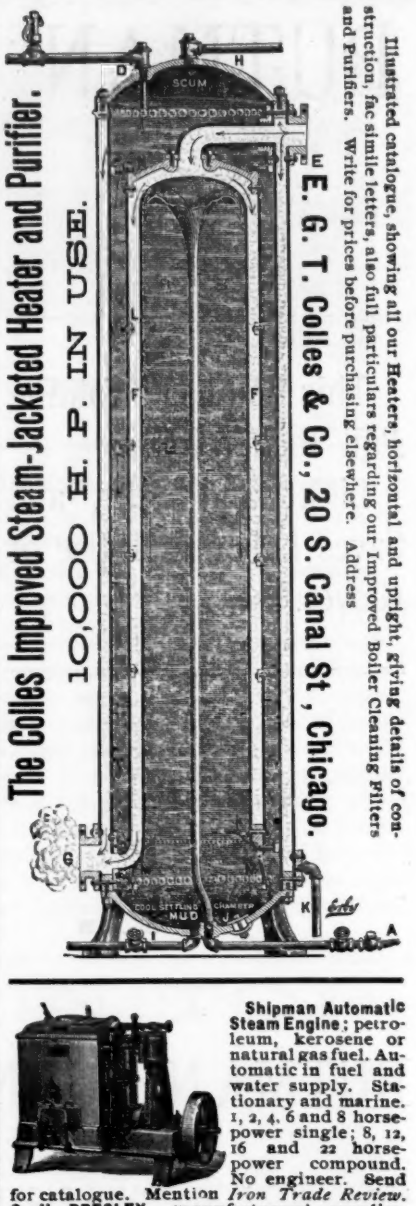

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⅜, ¾ and ⅞ by ⅜ to ⅝ inch	2 35

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1 to 1⅜ inch	1 95
2 to 2¾ inch	2 15
2¾ to 3¼ inch	2 45
3⅜ to 4 inch	2 95
4¼ to 4½ inch	3 45
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⅜ to 1¼ inch	2 35
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⅞	2 75
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⅜ and 3-16 by Nos. 11 and 12	2 95
¾ and 11-16 by ¼ to 3-16 in	3 15
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Successors to Tuttle, Oglebay & Co.,

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FROM MARQUETTE, GOGEBIC AND MENOMINEE DISTRICTS,

CLEVELAND, OHIO.

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Exclusive attention given to

LAKE SUPERIOR AND MENOMINEE RANGE

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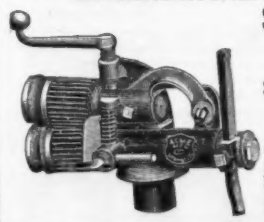
Perry-Payne B'ld'g, Cleveland, O.

Acme Manufacturing Co,

Manufacturers of All Kinds of



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Springfield O.

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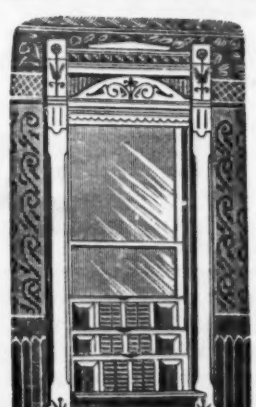
Pig and Bar Iron,

CLEVELAND, OHIO.

Hartman's Patent Inside Sliding Window Blind



is the most popular Blind in America. Architects & builders prefer it to any other, for merit, style, convenience and economy. Not Complicated. The Only Blind that is furnished with an automatic Burglar-Proof Lock, free of charge. This is an item of immense magnitude, and may save you many times the cost of blinds & perhaps life also, and the only blind that gives entire satisfaction. Thousands are in use.

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Pickands, Mather & Co.,

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—AND—

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JAS. PATTERSON, Sales Agent.

MACHINERY SUPPLY MARKET.

Anvils.

American.....₩ lb 9@10
Wrights.....₩ lb 9½

Bellows.

Blacksmiths' { Hill's.....dis 40 / Bullock's.... dis 50&10
Moulders'.....dis 40@40&10
Hand.....dis 40&10@50

Belting.

Boston Belting Co's standard.....dis 70
" " " extra.....dis 60&5
" " " best.....dis 55
Hoyt's Short Lap.....dis 45
Cleveland Rubber Co. extra standard.dis 60&10
Shultz Raw Hide Leather Belting, single.....dis 40
Shultz Raw Hide Leather Belting, double and Light Double.....dis 40
Standard, oak tanned.....dis 50@60
Alexander Brothers' pure oak tanned. ...dis 45

Blowers and Exhausters.

B. F. Sturtevant's.....dis 20
Boston Blower Co.,.....dis 35
Buffalo.....dis 35

Borax.

.....₩ lb 9½@10½

Chalk.

White.....₩ gross 50
White Crayon.....₩ gross 12@12½ dis 10
Red.....dis 70
Blue.....dis 85

Chucks.

Cushman's 4 Jaw Independent.....dis 45
" Combination.....dis 40
" Geared Scroll.....dis 30
" 2 Jaw Brass Workers.....dis 30
" Drill.....dis 35
Wescott's Scroll Combination.....dis 33⅓
" Independent.....dis 40
" Little Giant Drill.....dis 30
Horton's Universal.....dis 40
" Independent.....dis 45
Whiton's Independent.....dis 45
National Combination.....dis 40
Sweetland " .....dis 40
Almond Drill.....dis 20
Morse " .....dis 15
Skinner's Combination Lathe.....dis 33⅓
" Independent Lathe.....dis 40
" Universal Lathe.....dis 40
" Drill.....dis 15

Cutters and Reamers.

Cleveland.....dis 10@15
Pratt & Whitney.....dis 10@15
Standard.....dis 10@15
Brown & Sharpe, Milling Cutters.....dis 15
" " Gear Cutters.....dis 15

Crowbars.

Cast Steel.....₩ lb 4
Iron, steel points.....₩ lb 3¼

Drill and Drill Sockets.

Twist drills.....dis 50&10
Morse Taper and Straight shank to 1⅜".....dis 50&10
Morse Taper and Straight shank Larger than 1⅜".....dis 25
Drill Sockets.....dis 25
Standard Twist Drills.....dis 55@55&5
Cleveland " " .....dis 55@55&5

Emery.

	No. 4 to 46 gr.	No. 54 to 150. gr.	Flour, F.	C. F. FF.
Kegs, ₩ lb	4 c	5 c		2¼c
½ kegs ₩ lb	4¼c	5¼c		2¾c
¼ kegs ₩ lb	4¾c	5½c		3 c
10 lb cans, 10 in case	6 c	6¾c		5 c
10 lb cans, less than 10	10 c	10 c		7½c

Emery Cloth and Paper.

Barder, Adamson & Co.....dis 45@50
H. H. Barton.....dis 50@55&5

Emery Wheels.

Detroit.....dis 55@60
Norton's.....dis 55@60
Grant.....dis 55@60
Sterling.....dis 60
Celluloid.....dis 10&33⅓
Northampton.....dis 55
Crystal.....dis 65@70
Vitrified.....dis 60
Vulcanite.....dis 10&10

Files.

Nicholson.....dis 60&10@60&10&10
" X. F.....dis 25
Kearney & Foot.....dis 60&10@60&10&10
Black Diamond.....dis 60&10@60&10&10
Arcade.....dis 60&10@60&10&10
Disston's.....dis 65@70
Western.....dis 70
Stub's.....dis 25
Grobet's.....dis 30
Reynolds Bros.' Hand Cut.....dis 40
ndustry File Works, hand cut.....dis 50

Hammers.

P. S. W.....dis 40
Atha new list, Jan. 15, 1887.....dis 50
Heavy hammers and sledges under 5 lbs. 18c over 5 lbs 14c, new list.

Jack Screws.

Illinois Bolt Co. list.....dis 70

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4½	4	3½	3⅛
Hexagon	13½	11¾	8¾	6	5¾	5¼	5
Washers	9	8	7	5	4½	4⅛	4⅛

In lots less than 100 lbs, ₩ lb add ½c., 1lb boxes add 1c to list.

Nails (wire.)

List July 14, 1887.....dis 70 &10
Standard Penny Nails, ₩ keg card rate
{ Car lots.....$2.30
{ Less than car lots $2.40

Oilers.

Zinc and Tin.....dis 60
Brass and Copper.....dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ₩ doz.....dis 10@10&10

Packing, Steam.

Boston Belting Co.....dis 60
American Packing Hemp.....₩ lb 10@11
Russia Packing " .....₩ lb 14
Italian Packing " .....₩ lb 13@14
Plumbago Piston.....₩ lb 40
Morrison's " .....₩ lb 50
Square Flax " .....₩ lb 50
Sheet Rubber.....₩ lb 12&24
Excelsior Rubber.....₩ lb 48

Picks.

Railroads, 5 to 6 lbs.....$12 dis 60
" 6 to 7 lbs.....$13 dis 60

Pulleys.

Iron Pulleys, Walker List.....dis 45
Medart Pulleys.....dis 55
Split Wood Pulleys.....dis 50@55

Rivets.

Iron, Thousand, list November 17, ...dis 50
Iron, Ordinary, Cooper's Block and Carriage list November 17.....dis 50
Copper.....dis 50@50&10

Rope.

Manilla, ¼ inch and over.....₩ lb 15¾
Sisal, ¼ inch and over .....₩ lb 13¾

Sand Paper.

B. A. & Co.....dis45@50
H. H. Barton's.....dis40@45
New England Flint.....dis 40@50
Barton's Garnet.....dis 20

Saws.

Disston's Circular.....dis 45
" Band.....dis 20
" Scroll .....Net
Hack Saw Stubs.....dis 20
" " Eureka.....dis 20
" " Star.....dis 20
Saw Swages Disston's.....dis 20
Atkins' Cicular Saws.....dis 50
" Mill, Mulay and Drag Saws..dis 40&10
" Wood Saws.....dis 40&10
" Silver Steel Diamond Cross-cut Saws.....dis 70c per ft
" Dexter Cross-cuts.....dis 50c "
" Diamond " .....dis 30c "
" Tuttle Tooth Cross-cuts..dis 25c "
" One-man Cross-cuts.....dis 30c "
No. 1 Handles.....dis 23c per pair
No. 6 " .....dis 16c "
Excelsior Saw Tools.....$6 per doz
Perfection " .....$15 "
Detroit Saw Works, Circular.....dis 50
" " " Band.....dis 25
" " " Mulay.....dis 45

Screws.

Wood Screws—List Jan 27, 1889.

Flat head iron.....dis 50
Round head iron.....dis 40
Flat head brass.....dis 45
Round head brass.....dis 35
Square Cap.....dis 65
Hexagon Cap.....dis 60
Set C. H. C. P.....dis 70
Machine, flat head, iron.....dis 65
Machine, round head, iron.....dis 60
Bench and hand—
Lag or coach.....dis 75@75&10
Coach, patent gimlet point.....dis 75

Shovels and Spades.

Ames' list November 1, 1885.....dis 20
Dennis.....dis 5.25
Hussey & Binns, railroad.....dis 8.00

Taps.

Cards, Hand and Nut to 2 in.....dis 50
Carpenters' " " " .....dis 50
Morse " " " .....dis 50
Pratt & Whitney " " " new list dis 10
Machine Screw Taps.....dis 55
Pipe Taps to 2½ in.....dis 70
Stay Bolt Taps.....dis 25
Stove Bolt Taps.....dis 50
Pulley Taps.....dis 40

Twine.

	BC.	B.
No. 12, Flax Twine, ¼ and ½ lb Balls		21c@29c
No. 18 " " ¼ and ½ "		18c@28c
No. 36 " " ¼ and ½ "		16c@27c
2-Ply Hemp, ¼ & ½ lb Balls (Spring Twine)		11½c
3-Ply " 1 lb Balls		12@12½c
3-Ply " 1½ lb Balls		11@11½c
Cotton Wrapping, 5 Balls to lb		15@16c

Vises.

Solid Box.....dis 60
Parker's.....dis 20@25
Prentiss.....dis 20
Stephen's.....dis 25@30
Barrett's.....dis 30
Miller's Falls.....dis 40
Merrill's.....dis 10@15
Howard.....dis 30

Wire.

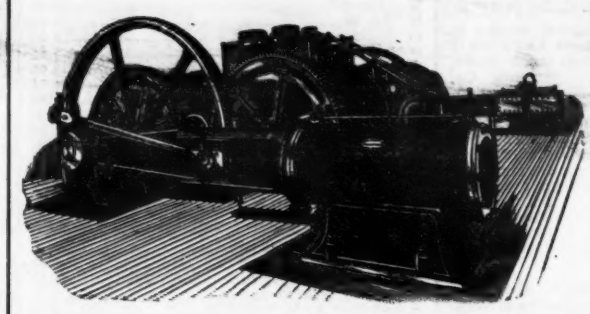
New List, Jan. 18, 1884

Brass and copper.....dis 20@25
Bright and annealed, Nos. 0@18...dis 70&10@75
" " Nos. 19@26..dis 75@75& 5
" " Nos. 27@36..dis 75&10& 5
Coppered Nos. 0 to 18, market list..dis 70@70& 5
Galvanized Nos. 0 to 18 " " .....dis 65&5
Tinned market Nos. 0 to 18.....dis 67½
Cast steel.....dis 50
Tinned Broom Wire.....dis 70&5@70&10
Annealed Fence, Nos. 8 and 9.....dis 75
Annealed Grape, Nos. 10 to 14.....dis 75
Stub's Steel Wire regular.....$6.00@lb dis 3

Wrenches.

Coe's genuine, ...dis 50
Girard Standard.....dis 70&10
Agricultural.....dis 75&10
Mechanics'.....dis 55&10,& 3
Bemis & Call's Combination .....dis 35
Donohue's Engineers.....dis 20&10
Lamson & Sessions Engineers.....dis 60
Billings & Spencer's Drop Forged.....dis 10
William's " " .....dis 10
Alligator " " .....dis 40

Webster, Camp & Lane Machine Co.



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Mining Machinery,

Improved Band Friction Hoisting Machinery, Geared or Direct Acting, for round or flat rope.

Wire Rope Haulage Machinery,

Endless or Tail Rope Systems.)

CORNISH PLUNGER AND BUCKET LIFT PUMPS.

Automatic or Slide Valve Steam Engines, Sheaves, Cages, Buckets, Etc.

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Magnetic Concentration of Iron Ore.

Ball-Norton (Monarch) Electro Magnetic Separator.

Phosphorus, sulphur, silica, hornblende and other impurities eliminated from Iron Ore, and non-Bessemer ore converted into Bessemer Ore. Samples treated without charge. Correspondence solicited.

H. E. COLLINS & CO., Agents Magnetic Separator Co.,

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CLEVELAND, O.

LIGHT AND HEAVY

IRON CASTINGS.

DAILY MELTING CAPACITY 75 TONS—SPECIAL FACILITIES FOR ECONOMICALY TURNING OUT SMOOTH CLEAN CASTINGS.

DUPLICATE WORK A SPECIALTY

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MANUFACTURER OF

VENTILATING FANS AND BLOWERS, HANGERS,

Carpet Cleaning and Laundry Machinery and other Special Machinery.

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Detachable and Roller

CHAIN BELTING,

MADE IN ALL SIZES OF

Malleable Iron and Steel,

DESIGNED FOR

Elevators, Conveyors, Drive Belts, etc.

For handling materials of all kinds.

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F. A. SACKMANN,

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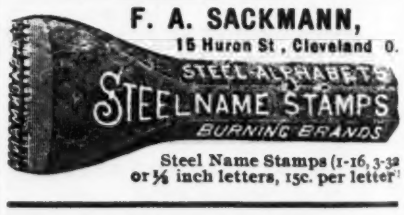

Steel Name Stamps (1-16, 3-32 or ¼ inch letters, 15c. per letter

PATENTS OSBORNE & CO., Patent Attorneys, 29 Euclid Ave., Cleveland, O. U. S. and Foreign Patents Procured. Patent Cases Litigated. Searches and Opinions as to Scope, Validity, Infringement and Title of Patent. Send for pamphlet.

PATENTS

WM. M. MONROE,

SOLICITOR & COUNSELLOR, City Hall Room 48.

PATENTS THOMAS P. SIMPSON, Washington, D. C. No atty's fee until Patent obtained. Write for Inventor's Guide.

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SPLENDID LOCATION FOR LIGHT MANUFACTURING.

On or about December 1, 1890, we will remove our entire plant to the new Vincent building, on Vincent street, between Music Hall and the Hollenden, now occupied by the Dangler Stove & Manufacturing Co. We shall take the entire building, which has a frontage on Vincent street of 47 feet, a depth of 00 feet, and an aggregate floor space of 24,000 square feet. Of this space we will rent to the right parties about 5,000 square feet, with power. The building s located in the centre of the important business district on Euclid avenue and Superior street, and was especially designed and constructed for power purposes. It is lighted on three sides, is equipped with large freight elevator, is heated with steam, and has gas and water on all five floors. Terms reasonable. Apply to

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OIL ALWAYS BELOW BURNERS---BY USING OUR SYSTEM.
OUR SYSTEM IS INSURABLE IN ALL INSURANCE COMPANIES.
WE GUARANTEE INSURANCE WHEN PLANT IS INSTALLED ACCORDING TO OUR SPECIFICATIONS.

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425 MAIN STREET, SPRINGFIELD, MASS.

FORGING, WELDING, BRAZING, MELTING, ANNEALING, HARDENING, TEMPERING.

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CHILION JONES, GANANOQUE, ONTARIO.
G. M. SMITH, LOS ANGELES, CAL.

SEND FOR CATALOGUES.

HARDWARE MARKET.

Augers and Bits.

Common augers and bits.....dis 70
Snell's.....dis 60&5
Cook's Douglass Mfg. Co.....dis 55
Russell Jennings' augers and bits.....dis 25
Expansive Bits, Clark's small, $18; large, $26.....dis 35@35&5
Hollow Augers, Ives'.....dis 25&10
Hollow Augers, Bonney's Adjust. ℔ doz., $48.....dis 40&10
Hollow Augers, Stearns' Adjust. ℔ doz., $48.....dis 20&10
Gimlet bits, common.....per gross $3 25@4 00
Standard Bit Stock Drills.....dis 50&10&5
Ship Augers.....dis 15&10@15&10&5

Axes.

Makers' and Special Brands—
First quality.....℔ doz $8 00
Others.....℔ doz $7 00
Full polished.....℔ doz $9 00

Bolts.

Cast iron barrel bolts.....dis 70
Cast iron shutter bolts, etc.....dis 70
Cast iron chain bolts.....dis 65&10
Ives' patent door bolt.....dis 60
Wrought iron barrel bolts.....dis 70
Wrought iron square bolts.....dis 70
Wrought shutter bolts.....dis 60&10
Sargent's list
Carriage, common, new list.....dis 70&10&7
Tire, common, new list.....dis 70
Carriage and tire, Philadelphia pattern.....dis 75&10
Stove bolts.....dis 60
Plow bolts.....dis 60&5
Machine.....dis 75&10@80
Rnds.....dis 75&10&80

Buckets, Elevator.

.....dis 50&10

Butts.

Wrought brass.....dis 75&10
Cast brass, loose joint.....dis 33⅓
Cast Iron—
Fast joint, narrow.....dis 50&10&5@60
Fast joint, broad.....dis 50&10@60
Loose joint.....dis 70&5
Loose joint, jap.....dis 70&5
Loose joint, jap. with acorns.....dis 70&5
Loose pin, acorns.....dis 70&5
Loose pin, japanned acorns.....dis 70&5
Loose pin, acorns, jap. plated tips.....dis 70&5
Wrought steel—
Wrought, fast joint, narrow.....dis 70&5
Wrought, fast joint, broad.....dis 70&5
Wrought, loose joint, broad.....dis 70&5
Table Butts, back flaps, etc.....dis 70&5
Regular inside blind.....dis 70&5
Light inside blind.....dis 70&5
Loose pin.....dis 70&5
Light loose pin.....dis 70&5

Carbonized Felt and Building Papers.

(POWERVILLE BRAND.)

Eberts Bros., Detroit.	Per roll of 500 sq. feet.
No. 1—Slaters'	$1.25
"A," Stringed Roofing, Light	1.50
"B," Stringed Roofing, Medium	1.75
"C," Stringed Roofing, Heavy	2 00
Stringed, Rosin-Sized	1.00

MILCELLANEOUS.

Asphaltum, Trinidad Refined, ℔ ton	$30 00
Asphaltum, Fine Grade, ℔ lb	.08
Coal Tar Felt, 1 Ply, ℔ lb	.02
Coal Tar Felt, 2 Ply, ℔ roll 108 sq ft	1 42½
Coal Tar Felt, 3 Ply, ℔ roll 108 sq ft	1.85
Roofing Pitch, ℔ gal	.09

Chains.

Revised List.

Trace, 6½-10-2.....℔ pair 1.03
Trace, 6½-10-3.....℔ pair .92 } .....50&10
Trace, 7-10-2.....℔ pair 1.11
German Halter Chain, list June, 1887...dis 50&10
German Coil, list of June, 1887.....dis 50&10@60
Galvanized Pump Chain.....℔ lb 5½@6
Jack Chain, Iron.....dis 75@75&5
Jack Chain, Brass.....dis 75

Chisels.

Socket Framing and Firmer.....dis 75
Socket Framing and Firmer, Buck Bros..dis 30
Socket Firmer and Framing, L. & I. J. White.....dis 30@30&5
Tanged Firmers.....dis 40&10

Cutlery.

Table.....net
Excelsior Pocket.....net

Fibre Ware—Standard.

	Nos. 1	5.	5X.
Pails, water, 12 qt	$4 00	$4 50	$.....
Dairy, 14 qt	4 50	5 00	.....
Fire 12 qt	5 00	.....	.....
Sugar	6 00	6 50	.....
Horse	.....	5 00	.....
Buggy	4 00	.....	.....
Chamber } 5 and Slop } 5X Commode } 14 qt.	6 50	7 50	8 50
Jars, slop, 5 and 5X 14 qt	8 00	9 00	10 00
Basins, wash—			
10½ inch	2 00	2 25	.....
12 inch	2 25	2 75	3 25
13½ inch	2 75	3 25	3 75
15 inch	3 25	3 75	4 25
Bowls, fruit	.....	2 50	.....
Servers, 12 in	.....	2 25	.....
Baskets, waste paper, 13 in	.....	6 00	.....
Spittons, "Daisy," pressed 8 inch	4 00	4 50	5 00
10 and 11¼ inch	6 00	6 50	7 50

No. 1 plain; No. 5 decorated; No. 5X White decorated.

Gimlets.

Nail and Spike.....dis 50&10&5
Double cut, low list.....dis 25
"Bee".....℔ gross $12, dis 25@25&5

Hanger

Barn door, old patterns.....dis 50&10&10@70
Climax, (Anti-Friction).....dis 60
Scranton.....dis 40
Kidder's.....dis 50&10@60
Terry's Patent.....5 in., $12; 4 in., $10, dis 50&5
Paragon.....dis 50&10
Richard's.....dis 30@30&10

Horse Nails.

No.	10	9	8	7	6	
Ausable, ℔ M.	23	24	25	26	28	dis 40
Putnam, ℔ M.	18	19	20	21	23	dis 15

Essex.....dis 25&10

Horse Shoes.

Burden, at factory.....℔ keg $4 00
R. I. Horshoe Co., Perkins' Imp. at factory.....℔ keg $4 00
Mule Shoes, at factory.....℔ keg $5 00

Knobs.

Carriage, japanned.....℔ gross 80c dis 60&10
Base, rubber tip.....dis 70&10&5
Hematite door knobs, new list.....dis 40&10@50
Door mineral.....dis 65c@68c
Door Por. japanned.....dis 75c@78c
Door Por. nickle.....$2 00@2 25
Door Por. plated.....$2 00@2 25

Locks, Bolts, Etc.

P. & F. Corbin, Locks and Bronze Goods.
Door locks, knobs and latches.....dis 60
Escutcheons and keys.....dis 60
Padlocks and padlock keys.....dis 70&10
Bell pulls, mineral, porcelain and jet.....dis 60
Bell pulls, genuine bronze.....dis 60&10
Lever bell pulls, genuine bronze.....dis 60&10
Butts', genuine bronze.....dis 60&10
Butts' bronze plated.....dis 60&10
Store door locks and latches.....dis 60&10
Store door handles.....dis 60&10
Shutter hinges&flaps, genuine bronze.dis 60&10
Shutter hinges, bronze plated.....dis 70
Flush bolts, genuine bronze.....dis 70
Shutter knobs, genuine bronze.....dis 50
Shutter bars, genuine bronze.....dis 60
Sash lifts, genuine bronze.....dis 60
Sash pulls and plates, genuine bronze.....dis 60
Push plates, genuine bronze.....dis 60
Drawer pull, genuine bronze.....dis 70
Letter box plates, genuine bronze....dis 60&10
Barn door locks.....dis 33⅓
Bishop's Buckeye Sash Locks.....℔ gross $4.80

Plumbs and Leve s.

Standard list.....dis 70&10
Pocket levels.....dis 70&10
Davis' inclinometers.....dis 10&10

Pumps.

Cistern, best makers.....dis 50&10@60
Pitcher spout, best makers dis 60&10@60&10&10
Pitcher spout, cheaper goods.....dis 70@70&5

Pokes, Animal.

Bishop's I. X. L.....℔ doz $6 00
Bishop's O K.....℔ doz $5 25
Bishop's Pioneer.....℔ doz $3 75
Bishop's American.....℔ doz $2 75

Rakes.

Cast steel.....dis 70
Malleable.....dis 70@70&5

Razors.

J. R. Torrey Razor Co.....dis 20
Wostenholme & Butcher.....$10@[illegible]...dis 10
Rifle razor.....dis $9 50 net

Rat Killers.

Schuyler's.....℔ gross $15 00

Scales.

Hatch, Counter, No. 171.....℔ doz $21 00
Hatch, Tea, No. 161.....℔ doz $6 75@7 00
Chatillon's Grocers.....dis 50
Family Turnbulls.....dis 30@30&10
Scale Beams, List of January 12, 1882.....dis 50&10@50&10&4

Screw Drivers.

Stanley R. & L. Co.'s Varnished Handles.....dis 65&10
Stanley R. & L. Co.'s Black Handles..dis 60&10
Sets interchangeables.....℔ doz $18 dis 25

Squares.

Steel and iron } dis 75&10@80
Nickel plated }
Disston's try square and T bevels.....dis 45&10
Winterbottom's try and miter.....dis 30&10

Tacks, Brads, Etc.

New List, Oct. 19, 1890.

American iron carpet tacks all kinds.....dis 70&10&10
Steel carpet tacks all kinds.....dis 70&10&10
Swedes iron carpet tacks, all kinds.....dis 70&10&10
Swedes iron tacks.....dis 70&10&10
Swedes iron Upholsterers' tacks..dis 70&10&10
Tinned Swedes iron tacks.....dis 70&10@10
Tinned Swedes iron Upholsterers' tacks.....dis 70&10&10
American iron cut tacks.....dis 67½&10&10
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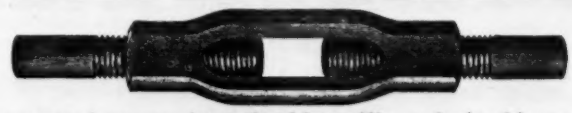

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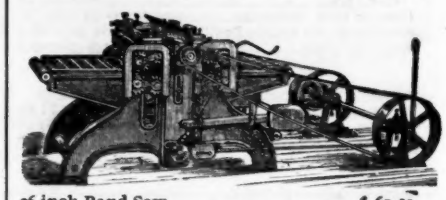

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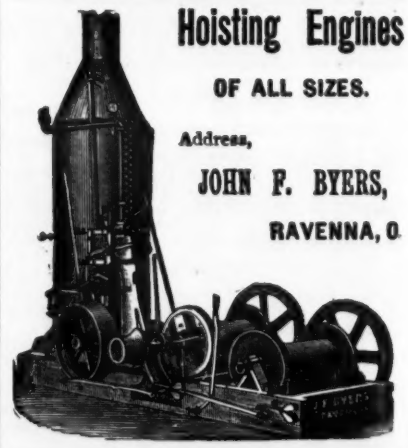

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N. Y. & Pitts. Express.....	‡5 38 a m	*8 25 a m
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Mahoning Accommo.....		†6 40 a m
Pittsburgh Express.....	†6 25 p m	
Youngstown Local.....	†8 05 a m	
Mahon'g div. & Pitts Local		*11 40 a m
Mahoning Val. Accom.....		†4 30 p m
Pittsburgh Express.....	†1 20 p m	11 10 p m
New York Express.....	*8 00 p m	.....

*Daily. †Daily, except Sunday. ‡Daily except Monday.

Cleveland & Canton Railroad.
(Standard Gauge.)

Depart for—
Zanesville and Coshocton—6:50 a. m., 3:00 p. m.
Canton—6:50 a. m., 3:00 p. m., 6:20 p. m.
Kent—6:50 a. m., 3:00 p. m., *5:45 p. m. 6:20 p. m.
Bedford—6:50 a. m., 11:10 a. m., 1:30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m. 10:35 p. m.
Newburgh—6:15 a. m., 6:50 a. m., 11:10 a. m., 1.30 p. m., 3:00 p. m., 4:40 p. m., *5:45 p. m., 6:20 p. m., 10:35 p. m.

Arrive from—
Zanesville and Coshocton—10:30 a. m.,6:30 p. m.
Canton, 10:30 a. m., 2:35 p. m., 6:30 p. m.
Kent—*8:10 a. m., 10:30 a. m., 2:35 p. m., 6:30 p.m.
Bedford—6:00 a. m., *8:10 a.m., 10:30 a.m., 1:05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p.m., 7:10 p.m.
Newburgh—6:00 a. m., 7:15 a. m., *8:10 a. m., 10:30 a. m., 1.05 p. m., 2:35 p. m., 4:15 p. m., 6:30 p. m., 7:10 p. m.
Trains marked * run daily.

Valley Railway.
FOR AKRON, CANTON AND MARIETTA.
Depot foot South Water Street.

	Depart.	Arrive.
Valley Junction Mail.....	*7 25 a m	*6 30 p m
Marietta Express.....	*11 15 a m	*2 45 p m
Bal'o. & Wash. Express....	*4 30 p m	*10 25 a m
Cleve. and Canton Express	†6 30 p m	†8 15 a m

*Daily. †Daily, except Sunday.

J. T. JOHNSON, Gen. Supt. J. B. CAVEN, Gen. Pass. Agt.

From Cleveland Union Station.

PENNSYLVANIA LINES.

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Pittsburgh, Baltimore, Washington, Philadelphia and New York.	7 45 a m	d5 25 a m
	1 15 p m	12 50 p m
	d11 10 p m	6 35 p m
Wheeling and Bellaire.	7 45 a m	12 50 p m
	1 15 p m	6 35 p m
	*11 10 p m	.....
Alliance Accom.....	3 25 p m	10 10 a m
Ravenna Accom.....	5 00 p m	8 25 a m

d Daily. * Except Saturday. Other trains except Sunday.

From Cleveland Union Station.

Mt Vernon and Pan Handle Route

Cleveland & Pittsburgh R. R.

	Depart.	Arrive.
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon, Columbus, Xenia, Dayton, Cincinnati, Louisville, Indianapolis, St. Louis, and all points in the South and Southwest.	8 00 a m	d 7 00 am
	d 8 00 p m	5 40 p m
For Cuyahoga Falls, Akron, Orrville, Millersburg, Gambier, Mt. Vernon and Columbus.	1 15 p m	12 50 p m
For Cuyahoga Falls, Akron, Orrville, Chicago, and all points in the West and Northwest.	8 00 a m	5 40 p m
	3 25 p m	10 10 a m

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No. 70, Pittsburgh Accom.....	*11 25 a m
No. 64, New York & Pitts. Limited...	* 2 50 p m
No. 66, Mantua Accommo.....	* 4 20 p m
No. 74, Youngst'n Ex.....	† 6 00 p m
No. 68, New York & Pitts. Ex.....	*11 00 p m
	Arrive.
No. 61, N. Y. & Pittsburgh Express...	† 5 15 a m
No. 71, Youngstown Accom.....	* 7 15 a m
No. 65, New York & Pitts. Lim.....	* 9 55 a m
No. 67, Pittsburgh Accom.....	*12 45 p m
No. 73, Leavittsburgh Local.....	* 2 10 p m
No. 63, New York & Pitts. Ex.....	* 6 50 p m
No, 75, Mantua Accom.....	* 7 20 p m
No. 69, Youngstown Express.....	† 9 10 p m

*Daily. †Daily, except Sunday.

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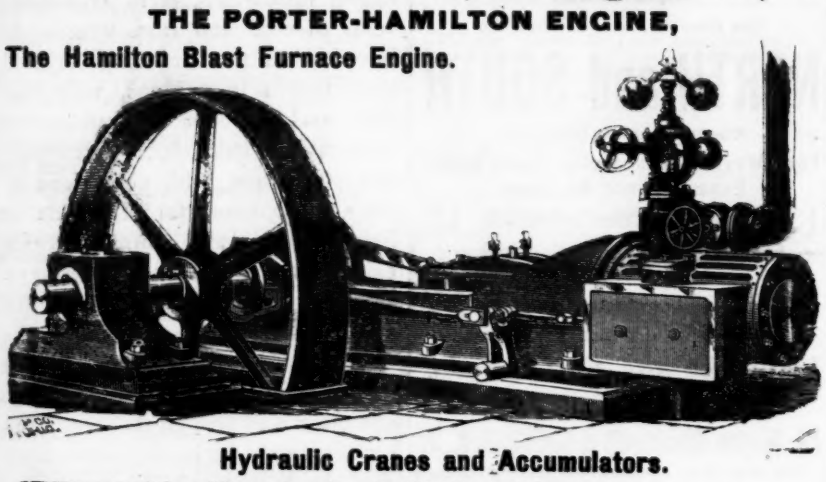

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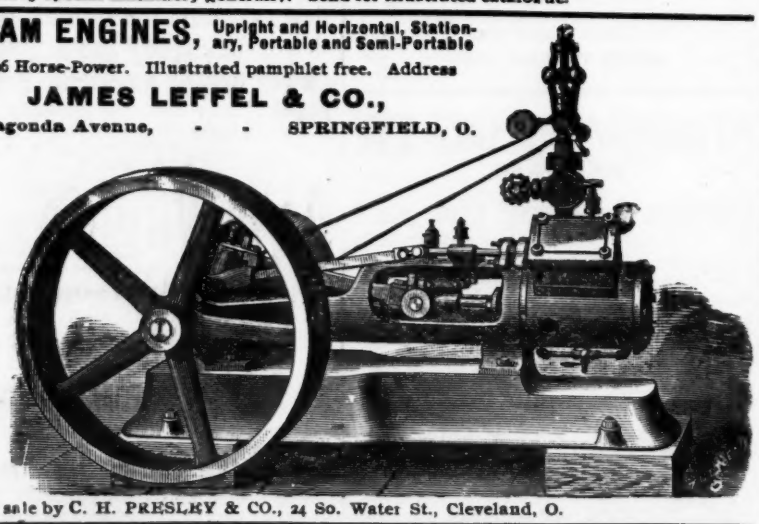

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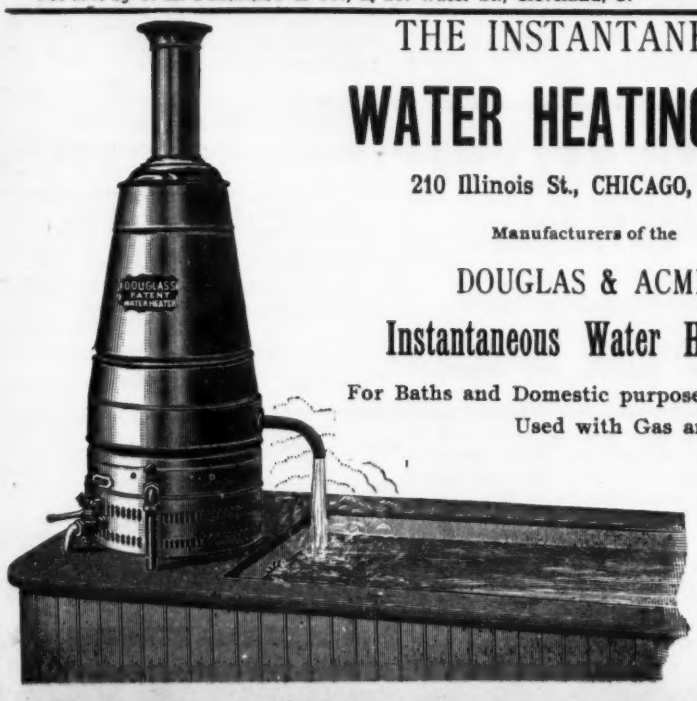

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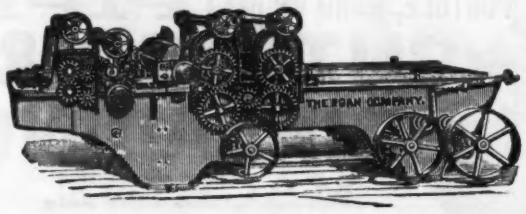

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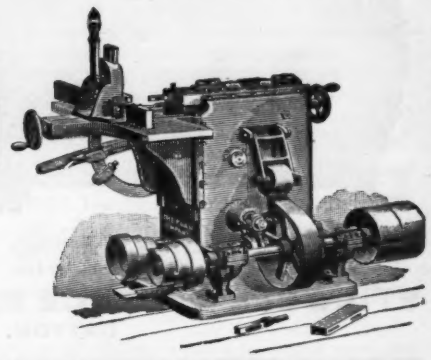

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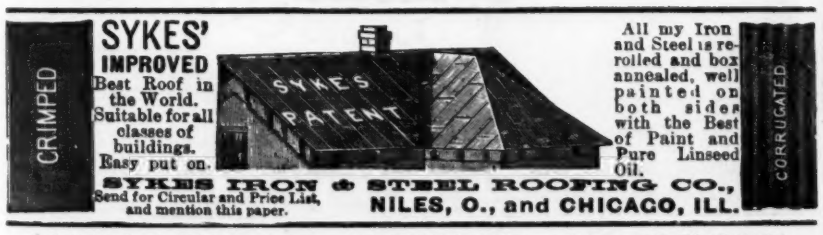
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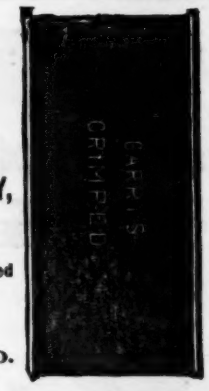

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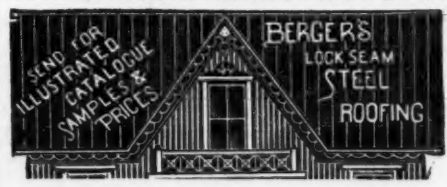

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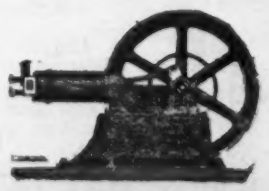

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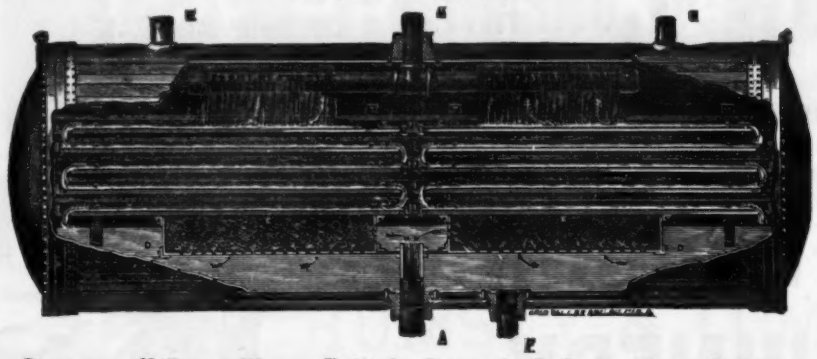

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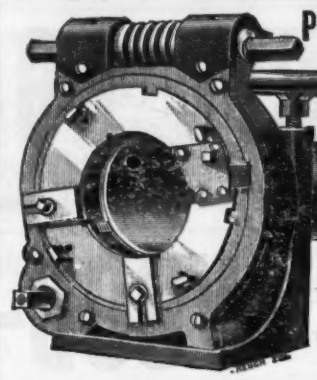

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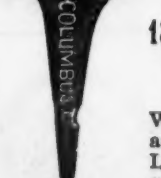

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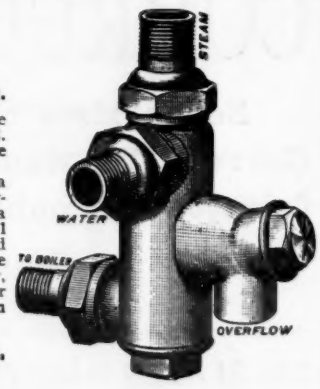

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